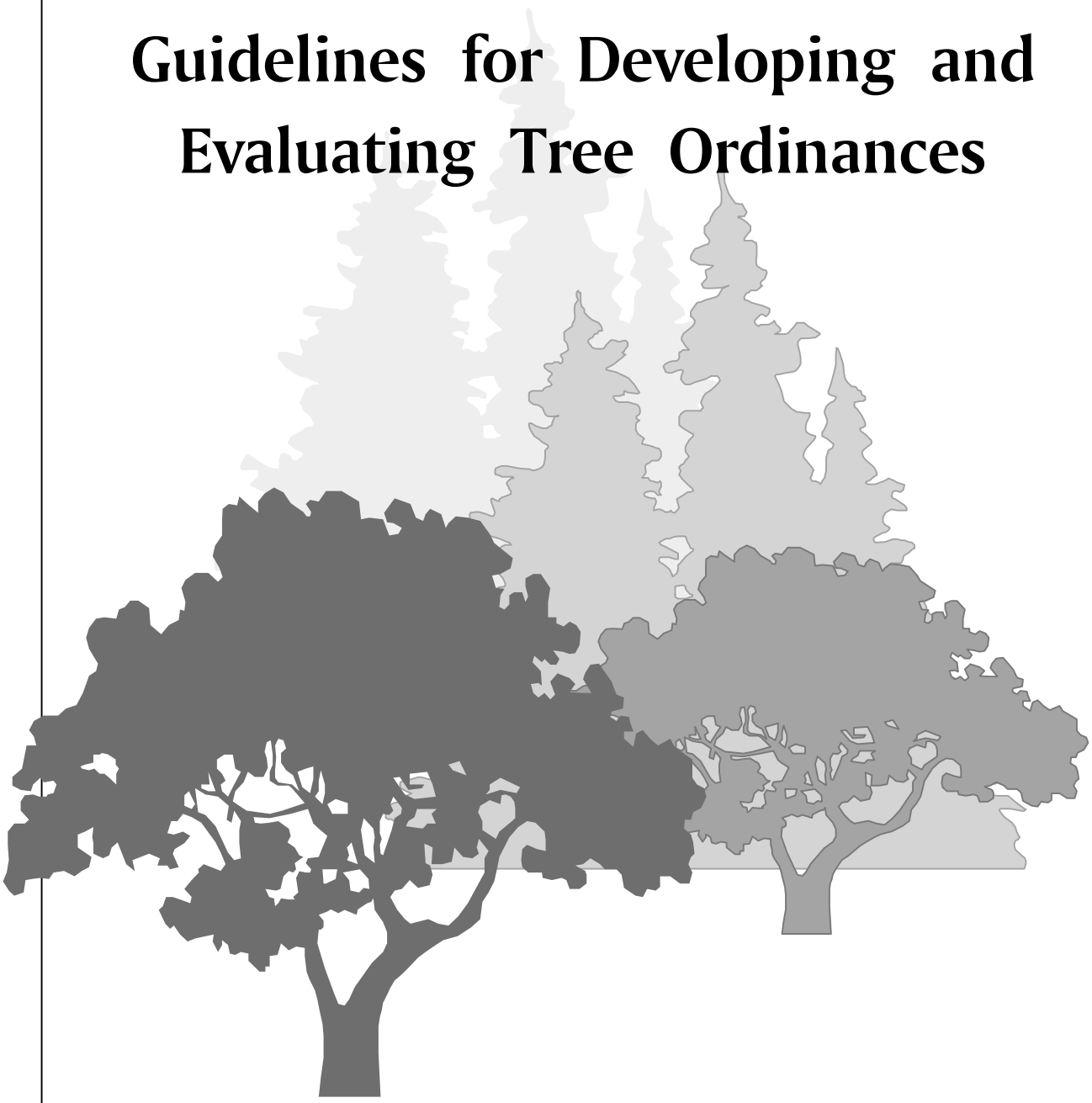
Guidelines for Developing and Evaluating Tree Ordinances



California Department of Forestry and Fire Protection, Urban Forestry Program

Guidelines for Developing and Evaluating Tree Ordinances

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for

California Department of Forestry and Fire Protection
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How to use this publication

Whether a community is large or small, rural or urban, in a natural forest or in the desert, the basic process for developing a tree ordinance is the same. In each case, the community needs to determine what it has to work with and what it hopes to achieve. It must then formulate plans to get what it wants, and finally, evaluate whether it is achieving its desired ends. This booklet is intended to guide you through this process.

Most users of this booklet will not need to read it straight through from cover to cover, but all should start by reading Part 1. The process we recommend for developing a tree ordinance, and how it differs from the approach that is commonly used, is explained in Part 1. It is important to understand the recommended procedure in order to effectively use the remaining sections of this booklet. Using the process presented in Part 1 will help you determine whether you actually need to develop or revise a tree ordinance, and to set definite goals you hope to accomplish with the ordinance.

Part 2 is a guide to drafting an ordinance. It shows how to select specific ordinance provisions to meet the tree management goals set by your community. Please note that this section *does not* present a "model" ordinance. Instead, it is a listing of provisions that can be used to help achieve specific goals. Individual ordinance provisions are presented and explained, and example text is provided. Using the input of local citizens, your community can select provisions and develop language that will yield an ordinance that is uniquely suited to its own needs and desires.

How can you tell if your tree ordinance is working? Evaluation is the key to answering this question. Part 3 is a technical guide to methods which can be used to evaluate and monitor the effectiveness of ordinance provisions. You may also wish to refer to this section as you work through the steps in Part 1.

This booklet is designed to be used by either citizen groups or local governments. However, development of a tree ordinance will be most effective when both groups work together. Some communities have found that forming a task force is an excellent way of ensuring cooperation between groups with diverse interests.

Part 1. Planning for an ordinance

More and more communities in California are beginning to recognize the very tangible benefits that trees provide in the urban environment. Healthy trees reduce air and noise pollution, provide energy-saving shade and cooling, furnish habitat for wildlife, enhance aesthetics and property values, and are an important contributor to community image, pride, and quality of life. Furthermore, many communities have realized that in order to protect and enhance their valuable tree resources, it is useful to view and manage their trees as a cohesive unit, the *community* or *urban forest*.

Tree ordinances are among the tools used by communities striving to attain a healthy, vigorous, and well-managed community forest. By themselves, however, tree ordinances cannot assure that the trees in and around our communities will be improved or even maintained. Tree ordinances simply provide the authorization and standards for management activities. If these activities are not integrated into an overall management strategy, problems are likely to arise. Without an overall strategy, management will be haphazard, inefficient, and ineffective, and the community forest will suffer.

Yet, throughout California and in much of the nation, it is this larger management view which is most commonly lacking when ordinances are developed. Local ordinances are often developed in response to public outcry over specific perceived problems. This "band-aid" approach frequently leads to ordinances that are not consistent with sound community forest management, and may in fact thwart good management efforts. For example, public outcry has led to the development of many ordinances designed to protect old "heritage" trees. Unfortunately, most of these same ordinances allow the routine destruction of younger trees. The end result may be an unsustainable community forest, short on young trees and long on old, declining trees. By focusing too narrowly on individual trees, such ordinances may contribute to the degradation of the community forest over the long term.

A tree ordinance is not a panacea for poor or inadequate municipal tree management. Nor is it a replacement for a comprehensive community forestry program that is fully supported by the local government and community residents. Properly applied, tree ordinances can facilitate good management of community tree resources. Improperly applied, ordinances can legitimize counterproductive practices and undermine the long term success of the community forest.

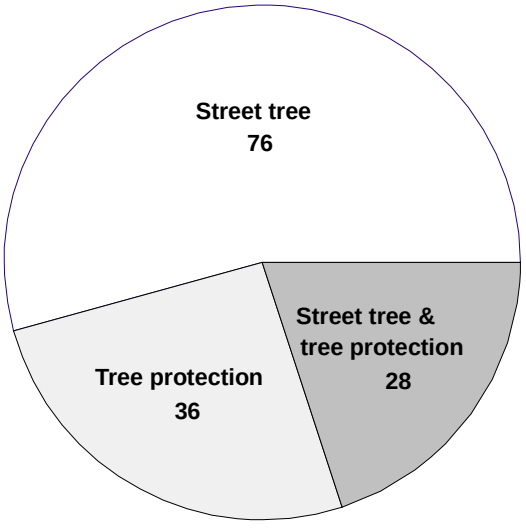
The current status of tree ordinances

What is the current situation with regard to tree ordinances in California today? To answer this question, we sent requests for tree-related ordinances to all of the counties and incorporated cities in California. We received 159 enacted city tree ordinances and 9 enacted county ordinances. This sample represents about 50% of the city and 80% of the county tree ordinances (Bernhardt and Swiecki 1989).

Types of ordinances

For the purposes of our review, we grouped tree ordinances into three basic categories. **Street tree ordinances** primarily cover the planting and removal of trees within public rights-of-way. They often contain provisions governing maintenance or removal of private trees which pose a hazard to the traveling public. Also included in this category are ordinances with tree planting requirements, such as those requiring tree planting in parking lots. **Tree protection ordinances** are primarily directed at providing protection for native trees or trees with historical significance. They usually require that a permit be obtained before protected trees can be removed, encroached upon, or in some cases, pruned. **View ordinances** are designed to help resolve conflicts between property owners that result when trees block views or sunlight.

Among cities, street tree ordinances are more common than tree protection ordinances, although many city ordinances include elements of both. County tree ordinances are most commonly tree protection ordinances. Seven of the nine county ordinances we received regulate tree removal on private property. View ordinances are relatively uncommon. We received view ordinances from only four cities and one county. Most of these are "self-enforcing", that is, they set forth a procedure through which private parties can resolve conflicts without direct intervention by the city or county.



City ordinances

Effectiveness of existing ordinances

The effectiveness of a tree ordinance can be influenced by many factors. Do the residents support or oppose various ordinance provisions, or are they even aware of them? Is the ordinance enforced adequately? Does the ordinance account for environmental limitations that affect tree health, growth, and survival? Does the local government have the financial resources to fulfill ordinance requirements? Since the answers to these questions will vary from place to place, even very similar ordinances can have quite different outcomes in different communities.

It was beyond the scope of this project to evaluate all of these factors for each community in California. Instead, we focused on the structural elements necessary for an effective tree ordinance. Although ordinances may vary widely in form, content, and complexity, an effective tree ordinance should meet the following criteria:

1. **Goals** should be clearly stated and ordinance provisions should address the stated goals.
2. **Responsibility** should be designated, and **authority** granted commensurate with responsibility.
3. **Basic performance standards** should be set.
4. **Flexibility** should be designed into the ordinance.
5. **Enforcement** methods should be specified.
6. The ordinance should be developed as part of a **comprehensive management strategy**.

Criteria for an effective tree ordinance

7. The ordinance should be developed with **community support**.

The first five criteria are key features of the ordinance itself. The last two criteria reflect the background in which the ordinance is developed. Although an ordinance meeting these criteria is not guaranteed success, ordinances lacking one or more of these elements will definitely be handicapped. In our review of city and county tree ordinances, we looked for evidence that the first six of these basic criteria were met.

Goals

A clear statement of goals is essential, since goals provide the basis for interpretation of the ordinance and evaluation of its effectiveness. However, only 52% (88) of the ordinances reviewed begin with a stated purpose which can be interpreted as the goal of the ordinance. Stated goals were most commonly lacking in street tree ordinances. Among street tree ordinances that did list a purpose, it was often of the form, "*to establish rules and regulations governing tree planting, maintenance and removal on the public right of way*". This type of goal suggests that the ordinance is seen as an end in itself, rather than as a tool to help achieve certain community forestry goals. Some street tree ordinances do show a clear link with a wider management strategy, as indicated by a goal such as "*to create a master plan governing tree planting, maintenance, and removal*".

Tree protection ordinances nearly always begin with a stated goal, such as "*to prevent wanton destruction of trees*", or "*to preserve as many trees as possible during the development process*". However, goals such as these may be too general to allow for meaningful evaluation. How many are "as many as possible"? The lack of clear, specific goals is a common shortcoming of existing tree ordinances in California.

Responsibility and authority

Of the ordinances reviewed, 54% (91) designate a single position responsible for enforcing the ordinance and carrying out the urban forest program. In the remainder of the ordinances, responsibility is split between two or more positions, or worse yet, is not designated.

In most cases, the most efficient way to manage the urban forest is to have a single person responsible for overseeing all tree-related activities. This allows for better coordination of management activities and reduces conflicts between departments. However, in small communities, it may not be possible to have a single central tree authority. Responsibility may be split between a tree commission, which sets policy and has administrative duties, and city staff, which is responsible for operations and enforcement.

The tree program manager should be vested with the authority necessary to carry out his or her responsibilities. A reasonably clear link between responsibility and authority is found in many tree ordinances. However, in some ordinances, responsibility appears to exceed authority, whereas in others, authority is granted, but specific responsibilities are not stated. The management of the urban forest is likely to suffer when responsibilities are ill-defined or the authority to act is not granted.

Basic performance standards

Many tree ordinances focus on setting specific standards that pertain to trees. A tree

ordinance should indicate which practices and conditions are acceptable and which are not. For example, damaging public trees is unacceptable in most communities and is addressed in many tree ordinances. Some communities find that damage to or removal of oaks and other native trees without cause is unacceptable, and address this in their ordinances.

Besides stating what is regulated, an ordinance should set basic standards for performance. It is in this area that many current ordinances are deficient. For instance, many ordinances require tree planting in conjunction with new construction. However, very few ordinances set standards for the eventual amount of canopy cover or shading that is to be provided, or the amount of species diversity to be achieved. Similarly, many ordinances require an extensive permit process before native trees can be removed, but few set a standard for the maximum amount of canopy that can be removed overall. If basic standards for performance are not set, it is possible that all individual actions taken will conform with the ordinance, but that the overall goals of the ordinance are never achieved. To be effective, standards must address the urban forest as a whole, and not be limited to individual trees.

Instead of setting basic performance standards, many ordinances have focused on very detailed implementation standards. For example, many ordinances include lists of species that are allowed or prohibited for use as street trees. Others specify the size of planting stock to be used in plantings. This is generally undesirable, because implementation standards are apt to change from time to time. As new methods and materials are developed and old ones fall out of favor, a local government may be left with an outdated ordinance. Furthermore, the specific standards may be inappropriate for the variability that exists within the many individual planting sites within the community. To allow for flexibility and updating as needed, detailed standards should be placed in an overall urban forest management plan or left to the discretion of the community tree program manager.

Flexibility

While ordinances should set basic performance standards, it is important that they allow for flexibility. For instance, the tree ordinance can make the community arborist or forester responsible for setting specific guidelines and making decisions on a case-by-case basis. This allows for greater flexibility than is the case when very specific implementation standards are included in the ordinance. Even if a community does not have personnel with the necessary expertise on staff, the ordinance can allow for the input of qualified professionals on specific issues. For example, many tree protection ordinances require a report by a qualified consultant as a part of the permit process.

About three-quarters of the ordinances have a process for appealing decisions. The appeal process provides a degree of flexibility, in that it serves as a check against the authority of the tree program manager. Ideally, this helps to ensure that decisions are based on all pertinent information, and that they stand on technical merit. Unfortunately, appeals may also serve to undermine good urban forest management if they routinely allow political pressure to override the decisions of competent tree specialists.

Enforcement

Enforcement is an important aspect of every ordinance. Only slightly more than half of the

ordinances we received contain an enforcement element. Although 48% (81) of the ordinances specify penalties for violations, only 24% (41) designate a position or positions responsible for enforcement. Thus, many tree ordinance provisions may not be enforced because nobody is specifically charged with this duty.

In ordinances with enforcement provisions, many kinds of penalties are employed. Fines, jail terms, and forfeiture of performance bonds are among the penalties invoked in both street tree and tree protection ordinances. Many jurisdictions also require specific replacement plantings as penalties. In some street tree ordinances, occupancy permits are withheld until required trees and landscaping are satisfactorily installed. Many of the penalties available appear to be sufficient to help deter offenders, but only if consistent enforcement makes it likely that violators will be cited and penalized.

Comprehensive management strategy

Few city and county tree ordinances appear to have been developed as part of a comprehensive management strategy. Only 6% (10) of the ordinances show clear evidence that they are an element of a comprehensive management strategy. The remaining ordinances do not show any relationship to an overall urban forest management strategy. This lack of integration between urban forest management and tree ordinances may be the most prevalent and serious problem with ordinances statewide.

Community support and ordinance success

Community support is critical to ordinance effectiveness, but community support cannot be legislated into an ordinance. Rather, the ordinance must be developed within the context of community values and priorities if it is to enjoy public support. Even a technically correct tree ordinance is apt to be ineffective without public support.

Passing a highly restrictive ordinance in a nonsupportive community is not only politically difficult, but may be counterproductive. Russo (1990) described such a situation that occurred after the passage of a tree protection ordinance. Local citizens attempted to circumvent the ordinance by cutting down trees before they attained the diameter specified for protection in the ordinance.

As a practical matter, most tree ordinances rely heavily on voluntary compliance. Few communities would support the concept of a patrolling "tree cop" that seeks out violations. However, citizens in many communities are willing to voluntarily comply with restrictions they perceive as reasonable, and report obvious violations to protect their local tree resources. To be successful, tree ordinances should not impose regulations that most local citizens are unwilling to support.

How ordinances have been developed

Very few tree ordinances are developed completely from scratch. In most cases, ordinance writers obtain one or more existing ordinances, or sample and model ordinances produced by various individuals and organizations. They then pick and choose the provisions that seem most suited to their situation, sometimes modifying them to varying degrees.

Most of the ordinances we reviewed were clearly based on ordinances from other jurisdictions, with various additions, deletions, or changes. In several instances, two or more communities had identical ordinances. Some frequently copied provisions are found unchanged in many ordinances, often complete with dated terms or concepts.

There are several shortcomings with this approach to drafting a tree ordinance. The most important of these is that the resulting ordinance is often enacted in the absence of an integrated tree management strategy. Without this underlying strategy to guide the process, inappropriate provisions may be included, or necessary provisions may be omitted. Furthermore, there may be a tendency to try to force the ordinance to accomplish goals that are more readily achieved through other means. The ordinance is often seen as an end in itself, rather than one of a number of tools which must be used to attain a healthy, vigorous, and well-managed community forest.

Developing a community forest management strategy

Given that many current tree ordinances have been developed without attention to the seven criteria set forth above, how can a community prepare a tree ordinance which will meet these criteria? The main point to remember is that the protection and enhancement of tree resources should be the overall objective of the community. This objective can only be attained through well-planned, careful management. Thus, the principal concern of the community should be to establish and maintain effective, long-term management of its tree resources.

Tree ordinances provide the legal framework for urban forest management by enabling and authorizing management activities. However, methods for managing natural resources such as the urban forest are continually evolving, and the input of trained professionals is critical. It is therefore important that **ordinances facilitate rather than prescribe management**.

Viewed from this perspective, it is clear that a tree ordinance is but one facet of the community forest management strategy. Therefore, in order to develop an appropriate and effective ordinance, it is necessary to first develop an overall management strategy. Most of the shortcomings attributed to tree ordinances can usually be traced to the lack of a clearly thought-out management strategy. Poor planning leads to poor ordinances, and even the best-written ordinance is unlikely to succeed in the absence of an overall urban forest management strategy.

Developing the management strategy

Ordinance development is simply one small part of developing an overall management strategy. Miller (1988) presents the management planning process in terms of three basic questions:

What do you have?
What do you want?
How do you get what you want?

The development of an appropriate tree ordinance may be a partial answer to the third question, i.e., it is one way of trying to get what you want. However, it should be clear that the first two questions need to be answered before the third can be addressed. Thus, assessment (determining what you have) and goal-setting (determining what you want) should precede any consideration of an ordinance.

In practice, answering the first two questions is often a back and forth process. Communities may have ideas about what they want before they fully assess what they have. However, an assessment of existing tree resources can help point out needs that might not be obvious, and will help the community to establish appropriate goals.

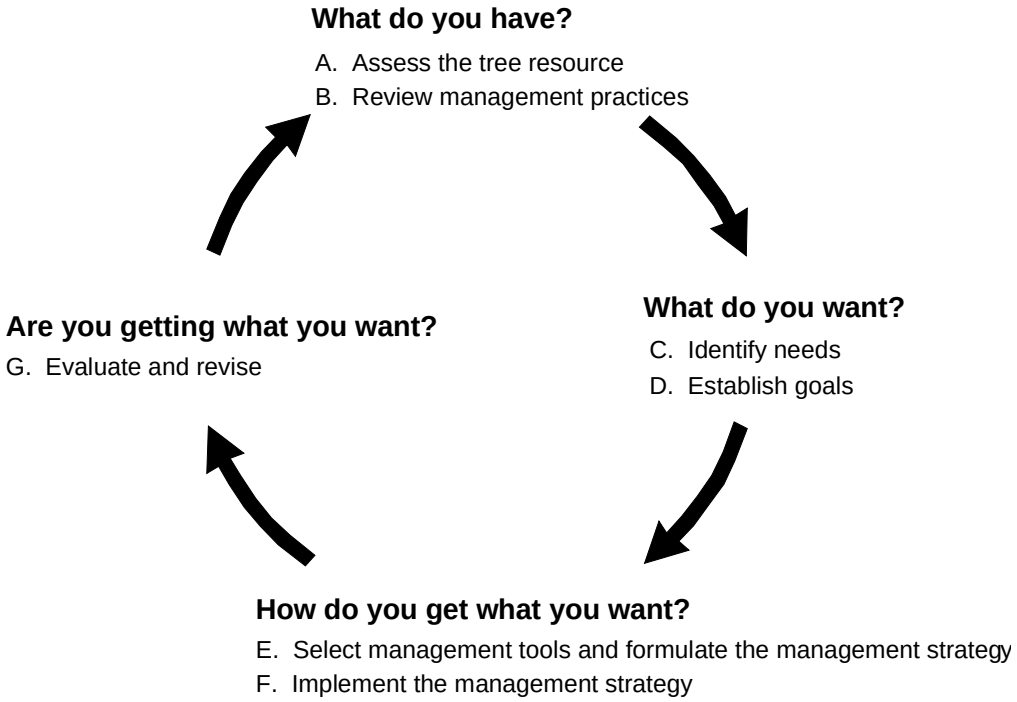
Since the urban forest resource and the external factors that affect it are continually changing, developing a management strategy must be an ongoing process. Adding a fourth question to the series allows the management planning process to cycle:

Are you getting what you want?

Miller (1988) represents this phase as a feedback step which connects the third question back to the first. If the planning process is to be effective, it is necessary to determine whether you actually achieve what you want. If not, methods for getting what you want may need to be changed. Alternatively, it is possible that what you get is no longer what you want, and goals will need to be revised as well.

We can define a number of specific steps that address each of these four basic questions. These steps have been defined in similar ways by various authors (Lobel 1983, Miller 1988, Jennings 1978, McPherson and Johnson 1988, World Forestry Center and Morgan 1989a). For the purposes of our discussion, we recognize seven distinct steps which are discussed below.

Working through these steps need not be overly complicated or arduous. The entire process is driven by the specific resources and goals of the individual community. By following the process outlined below, a small community with very modest tree management goals can develop a simple ordinance that addresses its limited goals. On the other hand, communities seeking to develop a comprehensive tree management program or expand their existing programs can do so following the same process. Ordinances developed through this process will be uniquely suited to the needs of each community.



WHAT DO YOU HAVE?

Step A. Assess the tree resource.

An assessment of tree resources provides the basic information necessary for making management decisions. It also provides a base line against which change can be measured. Ideally, this assessment should include all tree resources within the planning area of the municipality. However, in communities that are just starting to consider municipal tree management, an incremental approach may be more practical. In this case, the assessment may be focused on a certain

portion of the urban forest, such as street trees or trees in a particular area.

Tree resource assessments are based on various inventory methods, most of which require some type of survey. Complete tree inventories of all public trees are relatively common, and play a central role in many tree management programs. However, for the purposes of setting goals and initiating a management strategy, information from a representative sample of the urban forest will often suffice.

Information that may be useful for management planning includes:

- *total number of trees classified by species, condition, age, size, and location;*
- *problem situations, e.g. sidewalk damage, disease and pest problems, cross-referenced by the above tree data;*
- *amount of canopy cover by location.*

Inventories vary in complexity depending on the size of the community and the nature of the data collected. They can be made by city staff, consultants, or trained volunteers. In one small community we know of, an inventory of street trees was conducted as an Eagle Scout project. However, it is important to ensure that the data collected is valid and reliable, since this information provides a basis for decisions made in later steps in the process. Several simple sampling and evaluation techniques applicable to urban forestry are described in Part 3.

Step B. Review tree management practices.

An important part of understanding the status of the urban forest is knowing how it has been managed. This requires information on both past and current management methods and actions, such as:

- *municipal tree care practices, including planting, maintenance, and removal;*
- *ordinances, and the level of enforcement practiced (numbers of violations, permits and citations issued, penalties and fines collected);*
- *planning regulations and guidelines that pertain to trees, and numbers of tree-related permits granted, modified, or denied;*
- *activities of municipal departments and public utilities that impact trees.*

The specific types of information involved will vary by jurisdiction, depending on the level of previous and current tree management. Municipal records are the most reliable source of this information. However, records on maintenance or ordinance enforcement may not exist in some cases, and the information may have to be obtained by interviewing local government staff involved with these activities.

The point of this step is to identify all of the activities that affect trees in the community, especially those that are under municipal control of one form or other. For instance, ordinances and planning regulations seemingly unrelated to the tree program may impinge on tree resources and must be accounted for. Any proposed change in management should take into account both current and historical management practices, and identify all of the players involved.

WHAT DO YOU WANT?

Step C. Identify needs.

With information on the status of their tree resources and tree management in hand, a community is in a good position to assess its urban forestry needs. Urban forestry needs can be grouped into three broad categories, although many needs may actually fall in more than one category.

Biological needs are those that are related to the tree resource itself. Typical needs in this category include:

- *increase species and age diversity to provide long-term forest stability;*
- *provide sufficient tree planting to keep pace with urban growth and offset tree removal;*
- *increase the proportion of large-stature trees in the forest for greater canopy effects;*

-*ensure proper compatibility between trees and planting sites to reduce sidewalk damage and premature tree removal.*

Management needs refer to the needs of those involved with the short- and long-term care and maintenance of the urban forest. Common management needs include:

-*develop adequate long-term planning to ensure the sustainability of the urban forest;*
-*optimize the use of limited financial and personnel resources;*
-*increase training and education for tree program employees to ensure high quality tree care;*
-*coordinate tree-related activities of municipal departments.*

Community needs are those that relate to how the public perceives and interacts with the urban forest and the local urban forest management program. Examples of community needs include:

-*increase public awareness of the values and benefits associated with trees;*
-*promote better private tree care through better public understanding of the biological needs of trees;*
-*foster community support for the urban forest management program;*
-*promote conservation of the urban forest by focusing public attention on all tree age classes, not just large heritage trees.*

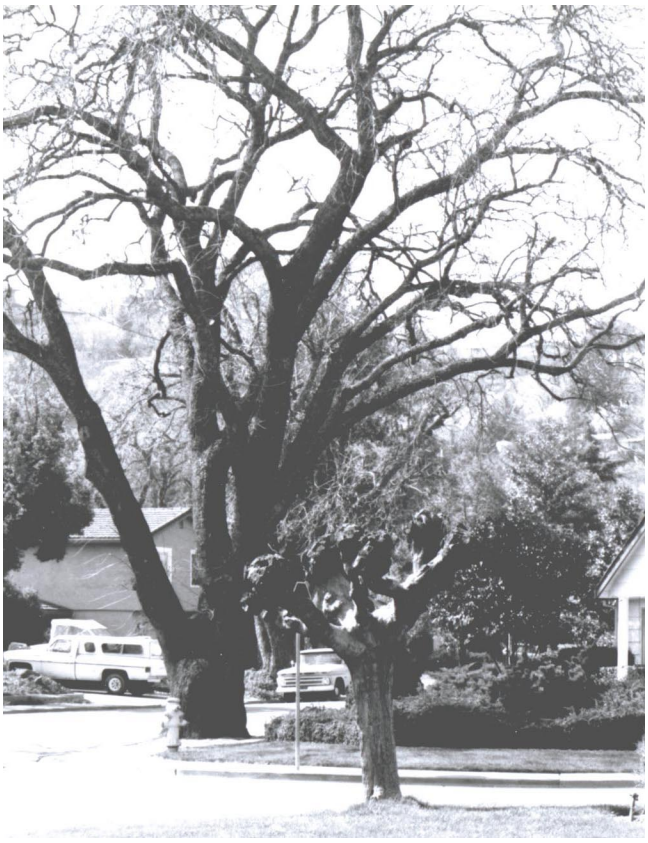
The needs listed above are common in communities throughout California (Bernhardt and Swiecki 1989). However, the specific needs of each community will vary, and may include others not noted here.

Step D. Establish goals.

Goals are set to address the needs that have been identified and to guide the formation of the management strategy. To ensure that realistic goals are established, community support, economic realities, and environmental constraints should be considered. Because of limited resources, communities are often unable to immediately address all of the needs identified. If this is the case, it will be necessary to prioritize goals. In setting priorities, it is important not to neglect goals that require a long-term approach in favor of those that can be achieved quickly.

It is absolutely critical that the community becomes involved in the process at this point. Most tree ordinances rely heavily on voluntary compliance by the public. Such compliance is only likely to be achieved if members of the community support the goals which have been set. Management goals reached through public involvement are likely to reflect community values and therefore enjoy public support. Public participation in the goal-setting process also serves an educational function, providing an opportunity for citizens to see how urban forest management affects their community.

Goals are the tangible ends that the management strategy seeks to achieve. It is therefore important to set goals which are quantifiable in some way, so that progress toward the goals can be monitored. For example, while it is admirable to seek to "improve the quality of life" or "protect the health and welfare of the community", such goals are generally too diffuse to be measured in any meaningful way. However a goal such as "establish maximum tree cover" can be made quantifiable by setting shade or tree density standards. Typical tree program goals which are consistent with good urban forest management are discussed in more detail starting on page 12.



HOW DO YOU GET WHAT YOU WANT?

Step E. Select tools and formulate the management strategy.

The objective of this step is to develop a management strategy that addresses your specific goals. There are many approaches that can be used to address each goal, and the pros and cons of each approach should be considered. Feasibility, practicality, legality, and economics should be considered in selecting the appropriate management tools. Some typical tools include:

- *public education programs;*
- *assistance and incentive programs;*
- *voluntary planting programs;*
- *mitigation guidelines;*
- *planning regulations and guidelines, including the general plan;*
- *ordinances.*

Community involvement and support continues to be important in this phase of the process. Management approaches and tools that are unacceptable to the community are unlikely to succeed. If a local government intends to push for more progressive tree management than the citizens are prepared for, it should choose tools that will build community awareness and support, including educational and incentive programs. Your assessment of current and past management practices (step B, page 8), should provide ideas about the effectiveness of various methods that have been used in your community. Public input and comment should be sought for any new approaches that may be contemplated or developed.

In analyzing the approaches or tools that may be used, the role of the tree ordinance in the overall strategy should become clear. In some cases, ordinance provisions will be necessary to authorize various management approaches, such as establishing the position of municipal arborist, requiring the development and implementation of a community forest master plan, or mandating a program of public education. In other cases, ordinance provisions may directly provide necessary parts of the strategy, for example by outlawing destructive practices.

The provisions placed in the tree ordinance should be directly related to the goals your community has established for its community forest. As noted earlier, these provisions should designate responsibility, grant authority, and specify enforcement methods. They should set basic performance standards, yet allow for flexibility in determining how these standards can be met. A guide to drafting a tree ordinance is presented in Part 2 of this document.

Step F. Implement the management strategy.

Although a plan may appear ideal on paper, it clearly cannot achieve anything unless implemented. This requires the commitment of resources necessary to hire personnel, enforce ordinances, run

educational programs, and carry out other components of the management strategy.

The number of steps involved in implementing the management strategy may differ between communities. Steps typically involved in implementation may include:

- *passing an ordinance,*
- *budgeting necessary funds,*
- *hiring a municipal forester or arborist,*
- *appointing a citizen tree advisory board,*
- *formulating a master tree management plan,*
- *developing public education programs.*

Since a number of steps are usually involved in implementing the management strategy, it is useful to map out an implementation schedule. This time/action schedule should show the steps that are involved and the time frame within which they should be completed. Progress checks should be built into the schedule to ensure that delays or problems are detected and dealt with. These progress checks could be in the form of required progress reports to the city council or county board of supervisors. It is important to maintain a high profile for the management program during implementation to foster public interest and maintain the commitment of the local government. If interest and support dissipate before the strategy is implemented, the efforts spent to get to this point may be for naught.

ARE YOU GETTING WHAT YOU WANT?

Step G. Evaluate and revise.

Even a successfully implemented management strategy must be monitored to ensure that progress is being made and standards are being met. Evaluation provides the feedback necessary to determine whether the management strategy is working. Periodic evaluation also provides an opportunity to reassess the needs and goals of the community. The management strategy may need to be adjusted to reflect new or altered goals. By providing for regular evaluation as part of the management process, the need for change can be identified before a crisis develops.

If you have set quantifiable goals, evaluating progress will be a relatively straightforward process. The types of evaluation techniques you will use will vary with the goal being evaluated. Evaluation methods which can be used to monitor ordinance effectiveness are described in Part 3 of this document.

Goals for community forest programs

Goals are central to developing an ordinance. Goals provide the basis for formulating and evaluating the management strategy and any tree ordinance that results from it. Thus, selecting appropriate and meaningful goals (step D, page 9) is crucial to the success of the entire process.

The goals described below are consistent with good urban forest management and are typical for municipal tree programs. Furthermore, they are specific enough to allow for evaluation. There is little point in establishing a goal if there is no practical way of determining whether progress is being made towards realizing that goal.

As noted in step E (page 10), a variety of approaches can be used to help attain any given goal. You will need to decide which approaches are most appropriate for your own community. If the goal is to be addressed through a tree ordinance, one or more provisions may apply. The types of ordinance provisions which can be used to address each goal are noted in general terms at the end of each discussion below. Specific provisions that apply to each goal are presented in the table at the beginning of Part 2.

1. Establish and maintain maximum tree cover.

The urban forest serves a wide variety of functions that promote the health, safety, and general welfare of residents. These functions include:

- *conserving energy, by providing shade and evaporative cooling through transpiration;*
- *reducing local and global air pollution by absorbing carbon dioxide and ozone, adsorbing particulate matter, and producing oxygen;*
- *reducing wind speed and directing air flow;*
- *reducing noise pollution;*
- *providing habitat for birds, small mammals, and other wildlife;*
- *reducing runoff and the potential for soil erosion;*
- *increasing real property values;*
- *enhancing visual and aesthetic qualities that attract visitors and businesses and serve as a source of community image and pride.*

All these benefits increase as canopy cover increases. By establishing and maintaining maximum tree cover, the community is able to realize the maximum benefits the urban forest can provide.

Tree ordinance provisions covering planting, maintenance, and removal of trees on public and private land are related to this goal. Performance standards for the amount of tree cover the community hopes to achieve and maintain along streets, parking lots, residential and commercial areas, parks and open spaces should be established in these provisions. A provision calling for development of an urban forest management plan is essential to this goal. This plan should provide for a sustained forest canopy through properly phased tree planting and removal.

2. Maintain trees in a healthy condition through good cultural practices.

A city is not likely to realize most of the benefits that the urban forest can provide if the trees are in poor health. Promoting tree health helps communities protect their investment in the urban forest. Public health and safety also depend on healthy trees. Improperly maintained and unhealthy trees often have an increased risk of breakage or failure, which can result in personal injury and property damage.

The health of urban trees is strongly affected by cultural practices. Proper and timely pruning can promote good tree structure and health, whereas topping and other improper pruning techniques can result in hazardous structure and decay. Irrigation is necessary for tree survival in many situations, but excess or improper irrigation practices can contribute to the decline of established trees, particularly native oaks. By providing for proper tree care and eliminating destructive practices, communities can go a long way toward maintaining their urban forests in a healthy and safe condition.

Possible tree program goals

- ☑ 1. Maximize tree cover
- ☑ 2. Healthy trees
- ☑ 3. Age and species diversity
- ☑ 4. Conservation
- ☑ 5. Appropriate selection and siting
- ☑ 6. Centralized tree management
- ☑ 7. Efficiency
- ☑ 8. Public education and support
- ☑ 9. Tree conflict resolution

Tree ordinance provisions that regulate tree maintenance practices such as pruning, and prohibit or regulate various activities that may harm trees are directly related to this goal. Management of specific disease or pest problems, such as Dutch elm disease, may be facilitated by provisions that limit species selection, require removal of diseased trees, or authorize other pest control measures.

3. Establish and maintain an optimal level of age and species diversity.

The trees that make up the urban forest have finite life spans and must be removed as they die. In addition, living trees are normally removed when their health, appearance, or structural integrity decline substantially, or when they conflict excessively with utilities and structures. The likelihood that a tree will need to be removed for one reason or another increases as the tree grows older and larger. If areas are planted to a single species at one time, a large percentage of the trees will need to be removed over a short time period when they reach the end of their useful life. This results in a rapid reduction in canopy cover, and the loss of many of the benefits provided by the urban forest. This undesirable situation is less likely to occur if the urban forest is composed of a variety of tree age classes and species.

Species diversity also helps stabilize the urban forest by buffering it from pest and disease epidemics. Many insect pests and plant pathogens can only attack one or a few tree species. When large areas are planted to a single susceptible species or variety, large

outbreaks and epidemics can arise which have serious consequences for the health, appearance, and longevity of the urban forest. Using a diversity of tree species helps to reduce the reproduction and spread of pests and pathogens. Furthermore, even if a severe disease or pest problem does develop on a given species, the condition of the entire community forest is not jeopardized.

The ordinance provisions that most directly address this goal require the development of and adherence to a complete urban forest or street tree master plan. To address this goal, the plan should provide for species diversity in new tree plantings. It should also describe how removal and replanting throughout the community can be phased to attain a good mix of tree maturities.

4. Promote conservation of tree resources.

The benefits derived from the urban forest generally increase as tree size and canopy cover increase. Therefore, it is in the best interest of the community to protect its existing tree resources from loss or depletion. It is not possible to indefinitely preserve individual trees, since each tree will eventually die. However, it is possible to preserve both the urban forest and natural woodlands by restricting the indiscriminate removal of trees in all age classes, and by making provisions for natural or human-assisted regeneration. This embodies the concept of *conservation*.

Many jurisdictions have attempted to address this goal with provisions that require approval to remove certain classes of trees under certain conditions. Unfortunately, in focusing solely on the "preservation" of individual trees, conservation of tree and forest resources is often overlooked. For instance, some ordinances have focused on protection during new construction, but make no provisions to ensure that trees will be retained after construction is completed.

Ordinance provisions that address this goal should conserve stands of trees, rather than only individual tree specimens. They should prevent depletion of the tree canopy over both short-term and long-term time horizons. Finally, they should set basic performance standards for the amount of tree canopy to be retained or achieved. Provisions related to the development of a master plan, and those regulating tree planting, protection, and removal are most directly related to this goal.

Conservation of tree resources alone may not be sufficient to address situations that require a more comprehensive resource management perspective. When jurisdictions seek to conserve functional forest and woodland ecosystems, such as in wildland parks or open spaces, the scope of management may need to be expanded. Other components of the plant community, wildlife, natural processes such as fire and flooding, and human land uses may also need to be considered.

5. Select, situate, and maintain street trees appropriately to minimize hazard, nuisance, hardscape damage, and maintenance costs.

Trees and structures, such as pavement, sidewalks, and curbs (collectively referred to as *hardscape*), are closely associated in street tree plantings, and this is frequently a source of problems for both. Many tree maintenance and hardscape damage problems that occur in street tree plantings result from incompatibility between the planting site and tree species. Street trees are often placed in woefully small planting spaces, and damage inevitably results as the trees grow. Furthermore, many tree species have been selected with little regard for root characteristics, despite the fact that roots are the most common source of problems associated with California's urban trees (Bernhardt and Swiecki 1989). Conflicts with utilities and damage to hardscape arise when tree species are not selected with proper attention to site limitations, or when planting sites are not designed to provide a hospitable environment for tree growth.

Inappropriate tree selection is often the underlying cause for trees that become hazardous, are prone to breakage, or develop recurrent pest or disease problems. Inadequate planting sites are often responsible for poor tree growth and survival and excessive hardscape damage. By identifying and subsequently avoiding undesirable tree species, inadequate planting site specifications, and inappropriate tree-site combinations, it is possible to minimize problem situations and their high maintenance costs.

Ordinance provisions related to this goal empower the tree authority to set and modify standards for tree selection and planting sites. This goal is normally also addressed in the development of a comprehensive management plan.

6. Centralize tree management under a person with the necessary expertise.

Due to the wide variety of situations that can impact trees in the urban environment, tree-related issues may arise in a number of different municipal departments. In many jurisdictions, street trees are the responsibility of public works, while park trees are cared for by the parks department (Bernhardt and Swiecki 1989). In addition, projects approved by the planning department and work performed by the public works department often impact current or future tree resources. Utility companies, tree service firms, and private citizens are also involved in tree maintenance and removal, and some of these activities may be regulated by various municipal departments. Effective implementation of tree ordinances is likely to be hampered when responsibilities are split between different departments without overall coordination.

Unless all activities that affect trees are coordinated, departments may unintentionally undermine each other's efforts to conserve tree resources. For example, the planning department may require that certain trees be protected and maintained during development. Without coordination, the same

trees might be seriously damaged by trenching for underground utility work approved through public works.

To facilitate the coordinated management of urban forest resources, it is desirable to have a single person responsible for all tree-related issues. To be effective, this position should serve as a clearinghouse for information on activities that may affect trees. The position should also have authority to approve, deny, or condition any activities in accordance with the jurisdiction's management plan, policies, and ordinances. Clearly, the person in this position should have the technical background appropriate for this complex job. Many jurisdictions do have a community arborist or forester, but this position often lacks sufficient authority to effectively manage the urban forest.

Although small communities may lack the funds for a full-time tree specialist, many of the administrative functions of the community forester may be filled by a tree board or commission. The necessary technical input may be obtained from public or private sector tree specialists. Alternatively, several smaller communities might band together to arrange for a shared "circuit riding" urban forester.

Ordinance provisions that establish the responsibilities, authority, and qualifications of the municipal tree program manager relate directly to this goal. Other related provisions direct how coordination between municipal departments is to be established for operations that may affect trees.

7. Promote efficient and cost-effective management of the urban forest.

Financial resources are in short supply in many local governments. Even though tree care involves less than 1% of the total operating budget of most California cities (Bernhardt and Swiecki 1989), economic realities dictate that all municipal programs strive for efficiency and cost-effectiveness.

To operate efficiently and ensure that resources are directed toward the most critical activities, a tree program must have a clear set of priorities and a long-range plan. Although short-term savings may be achieved by deferring tree maintenance, long-term costs will be lowest when resources are spent on preventing problems, rather than dealing with them after the fact. For example, a program of early and regular tree maintenance helps prevent later, more costly problems and prolongs tree longevity. Time and money spent up front on high quality plant materials and proper site preparation will be less expensive than dealing with all of the problems that arise when poor planting stock and inadequate installation procedures are employed. Likewise, time spent on properly pruning young trees will reduce the need for more expensive pruning or tree removal that would be required to correct structural problems.

This goal is addressed in provisions that spell out the responsibilities of the tree program manager. These responsibilities should include short- and long-range planning for the tree program, setting maintenance priorities based on long-term benefits, and tracking maintenance costs. Many of these aspects would also be addressed in provisions related to the urban forest management plan.

8. Foster community support for the local urban forestry program and encourage good tree management on privately-owned properties.

To achieve urban forestry goals, the local government needs the support of the citizens in the community. In most jurisdictions, the overwhelming majority of the trees which make up the urban forest are on private property. For all practical purposes, the care of these privately-owned trees is up to the residents of the community. A local government cannot completely control tree management on private lands, but it can take steps to promote proper management of privately-owned trees. Educational and incentive programs are positive ways to encourage good tree care within the community.

It is important that local citizens understand the relationship between urban forestry goals and specific actions taken to achieve these goals. Otherwise, support for the overall program goals may not translate to support for the program itself. Programs to educate citizens about, and involve them in, the local urban forestry program will help increase public support and interest in the program. Voluntary compliance with tree ordinances is likely to be improved if citizens understand and agree with the management approaches implemented through the ordinance.

Provisions that address this goal include those calling for the formation of a citizen tree commission and the establishment of educational and other outreach programs. Conducting such programs may be the responsibility of either the tree program manager or the tree commission. Incentive programs, such as those providing for cost-sharing, grants, or loans for tree planting or maintenance, are also related to this goal.

9. Facilitate the resolution of tree-related conflicts between citizens.

Trees sometimes become the focus of conflict between property owners when they obscure scenic views or keep sunlight from reaching solar energy collectors. For example, such conflicts may become important where property values are related to specific views. The community may wish to set up a mechanism by which such conflicts may be resolved with a minimum of impact to the community's tree resources.

This goal is addressed through a special set of provisions (see page 57) establishing a mechanism for resolving disputes over trees which obstruct light or views. The provisions covering this goal may be included in the tree ordinance or enacted as a separate view or solar access ordinance.

Part 2. Drafting an ordinance

After working through the steps outlined in Part 1, your community may find that a tree ordinance is necessary to further its urban forestry goals. This section is designed to assist you in drafting an ordinance that addresses your specific goals.

Tree ordinances are typically made up of provisions that can roughly be separated into two categories. The first category, which we refer to as basic provisions, are typically found in most ordinances, regardless of their purpose. The first 15 provisions in the table on page 19 fit into this category. Most of these are basic structural elements necessary for an ordinance to function. You should review all of these basic provisions to determine which should be incorporated into your tree ordinance. The provisions marked with an asterisk (*) are especially critical, and should be included in virtually any tree ordinance. Municipal legal staff should also be consulted for an opinion on the legal ramifications of including or omitting any of these basic provisions.

The second category includes provisions that are directed toward specific goals. Provisions from this category should be selected based on whether they are appropriate to your community and consistent with your management goals. It is neither necessary nor desirable that every community adopt each of these provisions.

The goal-oriented provisions are numbered 16 through 37 in the table on the facing page, and begin on page 29. These provisions are cross-referenced to the nine management goals discussed in Part 1 (page 12) and presented in the box below. Since many of these management goals are interrelated, some provisions are referenced to several different goals. In assembling your ordinance, you should consider those provisions that correspond to the specific goals you have established.

You can produce a draft ordinance by combining the necessary basic provisions with the appropriate goal-oriented provisions. You may also decide to develop other provisions to address goals unique to your community. It is probably best to use simple prose in the initial draft. The draft ordinance should then be submitted to municipal legal staff for review.

Specific Community Forestry Management Goals

1. Establish and maintain maximum tree cover.
2. Maintain trees in a healthy condition through good cultural practices.
3. Establish and maintain an optimal level of age and species diversity.
4. Promote conservation of tree resources.
5. Select, situate, and maintain street trees appropriately to minimize hazard, nuisance, hardscape damage, and maintenance costs.
6. Centralize tree management under a person with the necessary expertise.
7. Promote efficient and cost-effective management of the urban forest.
8. Foster community support for the local urban forestry program and encourage good tree management on privately-owned properties.
9. Facilitate the resolution of tree-related conflicts between citizens.

Key to Ordinance Provisions

Ordinance provisions and their applications are summarized in the table below. Provisions marked with an asterisk (*) are minimum basic provisions and should be included in virtually all ordinances. Ordinance provisions appropriate for specific goals are indexed by the goal numbers in the box on page 18.

Number	Provision	Basic	Specific Goals	Page
1	Title	X		20
2	Findings	X		20
3	Purpose and intent	X*		20
4	Definitions	X*		21
5	Determination of definitions	X		21
6	Jurisdiction	X		21
7	Policies regarding trees	X		22
8	Local government disclaims liability	X		22
9	Interference with planting, maintenance, and removal unlawful	X		23
10	Appeals	X*		23
11	Penalty for violation	X*		24
12	Enforcement	X*		25
13	Performance evaluation of ordinance	X*		25
14	Severability	X*		26
15	Designate administrative responsibilities	X*	1 2 3 4 5 6 7 8 9	26
16	Establish a tree board or commission		6 8	29
17	Specify cooperation between departments and agencies		6 7	30
18	Develop a comprehensive management plan		1 2 3 4 5 7	31
19	Resolution of conflicts between trees and structures		1 2 4	32
20	Exemption from Solar Shade Control Act		1	33
21	Responsibilities of property owners		5	33
22	Help for citizens performing tree maintenance		2 8	34
23	Topping prohibited		2	36
24	Permit required for planting trees in the public right-of-way		5	36
25	Planting requirements		1 2 3 4 5	38
26	Situations which are declared to be public nuisances		2	39
27	Abatement of hazards and public nuisances		2	40
28	Licensing of private tree care firms		2	41
29	Harming public trees forbidden		2	43
30	Permit required to remove or prune city owned trees		1 2 4 5	43
31	Permit required to remove or prune protected private trees		1 2 4	46
32	Conservation of forest and woodland resources during development		1 3 4	51
33	Procedures to be followed in resolving tree disputes		9	57
34	Standards for resolution of tree disputes		9	58
35	Apportionment of tree dispute resolution costs		9	60
36	Recording for notification of future owners		9	60
37	Enforcement of tree dispute resolutions		9	61

Basic ordinance provisions

The provisions listed below are basic components for most tree ordinances. The minimum provisions that should be included in virtually any tree ordinance are marked with an asterisk (*). In deciding whether to include other basic provisions, you should consider whether they would be appropriate and useful in your community.

On the left side of the page is an explanation of the purpose of each ordinance provision, a list of its key elements, and notes on its use and implications. Example text for the ordinance provision is shown on the right side of the page and is taken, wherever possible, from ordinances presently in use in California. Example text is provided for illustration, and may need to be modified or replaced with language that is suited to meet local needs.

1. Title

Purpose: To give the ordinance a brief descriptive title.

This ordinance shall be known as the San Francisco Urban Forestry Ordinance.

[San Francisco Public Works Code Article 16 Section 800]

2. Findings

Purpose: To set forth the reasons the local government finds it necessary to adopt an ordinance.

Notes: This section is frequently used to present a list of benefits provided by trees and justify the local government's interest in protecting the tree resource. Findings from the evaluation of "what you have" (see Part 1) might also be included in this section.

Information obtained from a City survey of trees indicated a decline in the number of certain species of trees located on private property.

[City of Carmel-by-the-Sea Ordinance No. 89-18]

*3. Purpose and intent

Purpose: To set forth the goals to be achieved through the ordinance.

Notes: In this section, you should clearly state the goals you hope to achieve by enacting the ordinance. As noted in Part 1, it is useful to establish goals which are quantifiable in some way. However, this approach has not been taken in most existing ordinances. The example text is derived from the goals discussed in Part 1.

This ordinance establishes policies, regulations, and standards necessary to ensure that the city will continue to realize the benefits provided by its urban forest. The provisions of this ordinance are enacted to:

A. Establish and maintain the maximum amount of tree cover on public and private lands in the city;

B. Maintain city trees in a healthy and nonhazardous condition through good arboricultural practices;

C. Establish and maintain appropriate diversity in tree species and age classes to provide a stable and sustainable urban forest.

[Example code by the authors]

*4. Definitions

Purpose: To define key words which are to be used in the ordinance.

Notes: It should become clear which terms require a definition as the ordinance is drafted. Communities have found it necessary to define what they mean by such words as "tree", "street tree", "prune", "Director", "damage", "parkway" and many others. Sometimes a useful technique, illustrated in the example text, is to include in the definition what is *not* covered by the term.

For the purposes of this chapter, the following words and phrases shall have the meanings respectively ascribed to them by this section:

"Alter" means to take action by cutting or pruning any tree, or by filling, surfacing, grading, compacting or changing the drainage pattern of the soil around any tree in a manner that threatens to diminish the vigor of the tree; provided that, as used in this chapter, the term "alter" does not include:

1. Normal seasonal trimming, shaping, thinning or pruning of a tree necessary to its health and growth;...

[Fairfax Town Code Section 8.28.020]

5. Determination of definitions

Purpose: To establish an authority responsible for interpreting definitions.

Notes: The application of many provisions may hinge on the definitions of key terms. This provision reduces the chance that ordinance enforcement could be challenged on the basis of specific definitions.

In any case, the city forester shall have the right to determine whether any specific woody plant shall be considered a tree or a shrub. Such determination shall be final and not subject to appeal.

[Carmel-By-The-Sea City Code Section 12.28.040]

6. Jurisdiction

Purpose: To set forth the jurisdiction of the local government over certain groups or classes of trees.

Notes: The example is typical of street tree ordinances. Some cities claim jurisdiction over trees on private property under certain situations as well.

The City of Carpinteria shall have control of all street trees, shrubs, and other plantings now or hereafter in any street, park, public right-of-way or easement, or other public place within the City limits, and shall have the power to plant, care for, maintain, remove, and replace such trees, shrubs and other plantings.

[Carpinteria City Code Section 12.28.020]

7. Policies regarding trees

Purpose: To set guidelines for carrying out ordinance provisions.

Notes: Whereas a goal is a statement of what you hope to achieve, a policy sets forth guiding principles to be followed in trying to achieve the goals. Stated policies may be helpful in interpreting and implementing ordinance provisions.

It shall be the policy of the City to maximize the planting of trees alongside the streets of the city...

[Alhambra City Code Section 14.08.004B]

C. It is the policy of the city to line its streets with trees and to conduct a consistent and adequate program for maintaining and preserving these trees...

D. It is the policy of the city to encourage new tree planting on public and private property and to cultivate a flourishing urban forest.

[San Luis Obispo City Code Section 12.24.010]

Street tree plantings shall first be considered from the standpoint of the people using or passing along the streets and in terms of the broader community benefit. Of secondary consideration is the benefit, embellishment, or enhancement of the properties abutting the street.

[Carpinteria City Code Section 12.28.070]

8. Local government disclaims liability

Purpose: To avoid accepting liability for any personal injury or property damage caused by trees on private property.

Notes: Legal counsel should be consulted for an expert opinion on the drafting and validity of such clauses.

A provision of this nature is usually included if a local government claims the authority to abate hazardous trees or regulate tree pruning and removal on private property. The first example is typical of such provisions in street tree ordinances.

Nothing contained in this section shall be deemed to impose any liability upon the city, its officers or employees, nor to relieve the owner of any private property from the duty to keep any tree, shrub or plant upon any

> *street tree area on his property or under his control in such condition as to prevent it from constituting a hazard or an impediment to travel or vision upon any street, park, pleasure ground, boulevard, alley or public place within the city.*
>
> [Patterson City Code Section 12.13.160]

Thousand Oaks, which has an ordinance that regulates the removal of oak trees on private property, has a similar clause.

> *Nothing in this ordinance or within the Oak Tree Preservation and Protection Guidelines shall be deemed to impose any liability for damages or a duty of care and maintenance upon the City or upon any of its officers or employees. The person in possession of public property or the owner of any private property shall have a duty to keep the oak trees upon the property and under their control in a safe, healthy condition. Except as provided in Section 5-14.04(b), any person who feels a tree located on property possessed, owned or controlled by them is a danger to the safety of themselves, others or structural improvements on-site or off-site shall have an obligation to secure the area around the tree or support the tree, as appropriate to safeguard both persons and improvements from harm.*
>
> [Thousand Oaks City Code Section 5-14.07]

9. Interference with planting, maintenance, and removal unlawful

Purpose: To prohibit interference with persons involved in tree-related activities who are acting in their official capacity on behalf of the local government.

Notes: This provision may be unnecessary if other portions of code restrict interference with public employees acting in their official capacities.

> *No person, firm or corporation shall interfere with the director of public works or persons acting under his authority while engaged in planting, mulching, pruning, ..., or removing any tree, shrub or plant in any street, ..., or public place within the city ...*
>
> [Bakersfield City Code Section 12.40.070]

*10. Appeals

Purpose: To establish a procedure whereby decisions of the tree program manager can be appealed.

Key elements:
-Types of decisions subject to appeal
-Procedure for filing appeals
-Time limitations for appeals and responses to appeals
-Requirement to suspend actions during the appeal process
-Hierarchical sequence of appeals
-Rules governing the hearing process, unless provided for elsewhere

Notes: The appeal process provides a check against the authority of the tree program manager. However, it is important that decisions by appeal bodies be based on the ordinance and established policies rather than political pressure.

Any action of the director of recreation and parks may be appealed to and heard by the recreation and parks commission. To be effective, an appeal must be filed within ten (10) days after the decision of the director. The appeal shall be in writing and shall be filed with the director for placement on the commission's agenda. The appeal shall clearly specify the reasons for which a hearing is requested. After a hearing, the recreation and parks commission shall render its decision, which shall be final unless appealed to the city council. To be effective, an appeal to the city council must be in writing, state the reasons for the appeal, and must be filed with the city clerk within ten (10) days after notice of the decision of the recreation and parks commission is mailed to the applicant. The decision of the city council shall be final.

[Santa Maria City Code Section 27-13]

...Such hearing on appeal shall be de novo, and the appeals board shall be guided by the criteria and standards, and shall make findings in relation thereto, as are required for the issuance of a permit in the first instance...

[Town of Paradise Municipal Code Section 8.12.110B]

...Action under any permit, the issuance of which has been appealed, shall be suspended pending final decision of the city council on the appeal...

[Newark City Code Section 8.16.060]

*11. Penalty for violation

Purpose: To establish penalties for violating provisions of the ordinance.

Key elements:
-Legal categorization of violations
-Specific penalties, if not provided for elsewhere
-Legal means for stopping and correcting situations which constitute violations

Notes: The responsibility for enforcement of the ordinance should be designated as described in provision 15. Certain provisions may carry additional penalties. If this is the case, additional language such as "Except as provided for elsewhere in this ordinance...", should be inserted to reflect this.

(a) Violation of any section of this chapter shall be a basis for injunctive relief.

(b) Violation of any section of this chapter shall be an infraction.

[Santa Maria City Code Section 27-15]

Any person, partnership, firm, corporation, or other legal entity who violates any provision of this chapter is guilty of a misdemeanor punishable by a fine of not more than one thousand dollars, or by imprisonment in the county jail for a period not exceeding six months, or both such fine and imprisonment. All such violations which are of a continuing nature shall constitute a separate offense for each day of such continuance. Any violation of this chapter shall also constitute a public nuisance and may be enjoined and abated as provided by law.

[Corte Madera City Code Section 15.50.080]

The following penalty clause from Santa Rosa's draft tree protection ordinance uses a different tactic to obtain compliance during development and construction. Such a penalty would have little deterrent value if the violation was discovered after project completion.

The owner or occupant of any property on which a violation of the provisions of this Chapter was committed, if such violation was committed by the owner or a lawful occupant thereof, or committed with the permission or approval of either such person, shall be denied, for a period of two years from the date of the City's discovery of such violation, any approval or permit issued by the City for the development or further improvement of such property. Prohibited approvals or permits shall include, but not be limited to, conditional use permits, variances, and building or demolition permits. The provisions of this Chapter shall not apply to any approval or permit which is needed or required to maintain the health or safety of those occupying existing improvements on the property.

[Santa Rosa draft ordinance]

*12. Enforcement

Purpose: To designate the position responsible for enforcing the ordinance.

Notes: The authority designated to enforce the ordinance should always be indicated. However, a separate enforcement provision may not be necessary if the responsibility for ordinance enforcement is specified under provision 15 below. It is normally preferable to vest enforcement authority with the tree program manager.

The Public Works Administrator is hereby charged with the responsibility for the enforcement of this ordinance and may serve notice to any person in violation thereof or institute legal proceedings as may be required, and the City Attorney is hereby authorized to institute appropriate proceedings to that end.

[City of Lemoore Ordinance 8610 Section 10-1.12]

*13. Performance evaluation of ordinance

Purpose: To provide for evaluation of the success of ordinance provisions.

Key elements:
-Position responsible for evaluation and reporting (unless specified in provision 15)
-Actions required in case of unsatisfactory performance

Notes: Perfection is seldom achieved on the first attempt. As noted in Part 1, the management planning process is incomplete without review, evaluation, and revision. One way to ensure that evaluation does occur is by including a provision that mandates a periodic performance evaluation of the ordinance. In addition to evaluation, this provision should establish a mechanism for revision of the ordinance if goals are not being achieved.

The tree program manager shall collect and maintain all records and data necessary to objectively evaluate whether progress is being made toward the stated goals of this ordinance. An annual summary and analysis of the evaluation, and recommendations for action shall be prepared at the direction of the tree program manager and presented to the City Council. The City Council shall consider the report and recommendations and take all actions deemed necessary to accomplish the goals of this ordinance. These actions may include, but are not limited to, revision or amendment of this ordinance or the adoption of other resolutions or ordinances.

[Example code by the authors]

*14. Severability

Purpose: To prevent the whole ordinance from becoming invalid if any part of it is declared invalid by the courts.

Notes: This provision is included in many ordinances as a matter of course. It is probably unnecessary to include in very short ordinances.

Should any part or provision of this ordinance be declared by a court of competent jurisdiction to be invalid, the same shall not affect the validity of the ordinance as a whole or any part thereof other than the part held to be invalid.

[Town of Atherton Ordinance 444 Section 7]

*15. Designate administrative responsibilities

Purpose: To assign responsibility and authority for implementation and enforcement of the ordinance.

Key elements:
-Position(s) responsible for implementing provisions of the ordinance
-Responsibilities assigned to each position
-Confirmation of authority necessary to carry out specified duties

Notes: A provision to designate responsibility for ordinance implementation is a basic requirement of any tree ordinance. This provision can also be used to help accomplish any of the specific

urban forestry management goals, since it assigns the responsibility and authority for management activities.

Although it is preferable to centralize tree management under the tree program manager, other municipal departments or a citizen tree advisory board may have complementary responsibilities. Listing the responsibilities of all parties involved in the tree management program in one section makes it easier to avoid conflicting or overlapping responsibilities.

Tree program manager

As the lead position for the management of municipal tree resources, the tree program manager should be vested with the authority necessary to carry out his or her many responsibilities. The actual list of responsibilities will vary with each community, but may include:

-developing and updating the comprehensive management plan;
-implementing a monitoring program to evaluate whether goals are being met;
-directing municipal tree care operations, including planting, maintenance, and removal;
-preparing the municipal tree care budget;
-seeking funding from state, federal, or other granting agencies;
-evaluating and approving permits for activities that may affect trees;
-conducting community outreach and education programs;
-enforcing ordinance provisions.

The tree program manager should have the expertise necessary to carry out the many complex duties of the position. Minimum qualifications for this position can also be specified in this section.

In the first example, the Director of Public Works serves as the community forester. In this example, responsibility may exceed authority to some degree.

> *The director of public works shall, by use of city employees or private contractors, plant, maintain and otherwise care for, or if necessary remove trees in any public place in the city. The responsibilities of the director of public works shall include but not be limited to, the following:*
>
> *1. Prepare an annual program for tree planting and tree care in public places of the City;*
>
> *2. Recommend to the board of directors changes or additions to the Master Street Tree Plan;*
>
> *3. Develop maintenance standards as they relate to street trees in public places;*
>
> *4. Inspect the planting, maintenance and removal of all trees in public places;*
>
> *5. Make determination of tree removals in public places;*
>
> *6. Review all landscaping plans as they affect trees in public places; and*
>
> *7. Act as advisor to the Design Committee of the City.*
>
> [City of Pasadena Ordinance 5454 Chapter 8.52.030]

A more specific link between responsibility and authority is seen in the second example.

> *The Director of Planning and Community Development, under the general supervision of the City Manager, shall have the authority and responsibility to do the following:*
>
> *1. Administer and enforce the provisions of this Chapter...*
>
> [City of Ceres Municipal Code Section 12.16.100]

In the third example, responsibilities for monitoring and reporting on the tree program are clearly stated.

> *The Park Superintendent shall prepare and maintain all necessary maps, plans, and records relating to the various functions carried on under this chapter.*
>
> *The Park Superintendent shall report to the Council annually on the work and activities carried on under the provisions of this Chapter...*
>
> [City of San Buenaventura City Code Section 8413]

Throughout this document, we have emphasized the importance of a well-informed and supportive populace to the community forestry program. The responsibility for conducting a public education program may be assigned either to the tree program manager or the tree commission. In either case, the provision should state the overall goals of the education/outreach program, as in this example.

> *Public Education. The Division shall undertake an on-going program of public outreach and education in order to promote public understanding of the City's urban forest and public adherence to the standards and procedures established under this ordinance.*
>
> [San Francisco Public Works Code Section 804h]

Tree advisory board

In many communities, the tree advisory board or commission is instrumental in evaluating needs, setting goals, and establishing policy for the community forestry program. The tree advisory board may also hear appeals of decisions made by the tree program manager.

In small communities, the tree advisory board may act in lieu of a tree program manager, performing many of the administrative functions listed above. However, as an appointed body, the tree board is not normally in a position to enforce the tree ordinance on a day-to-day basis. In such situations, enforcement responsibility should be assigned to a municipal staff position (see provision 12).

> *The duties of the Tree Committee shall be as follows:*
>
> *1. To study the problems and determine the needs of the City in connection with its tree program.*
>
> *2. To recommend to the City Council the type and kind of trees to be planted upon such City streets or parts of City streets, parks, or public places.*
>
> *3. To assist the properly constituted officials of the City, as well as the Council and citizens of the City, in the dissemination of news and information regarding the protection, maintenance, removal, and planting of trees on public lands, and to make such recommendations from time to time to the City Council as to desirable legislation concerning the tree program and activities for the City.*
>
> [La Palma City Ordinance No. 89-07 Section 4B]

Ordinance provisions for specific goals

Provisions consistent with the nine urban forestry management goals discussed in Part 1 (page 12) and listed in the table on page 19 are presented below. Provisions should be selected based on whether they are appropriate to your community and consistent with your management goals. Basic provisions necessary to complete the ordinance are presented beginning on page 20.

On the left side of the page is an explanation of the purpose of each ordinance provision, a list of its key elements, and notes on its use and implications. Example text for the ordinance provision is shown on the right side of the page and is taken, wherever possible, from ordinances presently in use in California. Example text is provided for illustration, and may need to be modified or replaced with language that is suited to meet local needs.

16. Establish a tree board or commission

Purpose: To establish a citizen advisory board, commission, or committee.

Key elements:
-Composition of the board
-Rules which govern the board
-Responsibilities and authority (if not defined in provision 15)

Notes: Tree boards provide a means to involve the public in urban forestry management. Tree boards can promote new and existing tree programs by motivating both local government and the public to support urban forest management. Typical functions of the tree board are described in provision 15 above, and will vary with the community. Sometimes city staff members are included on the tree board.

There is hereby created a City Tree Advisory Board which shall consist of five members....The members shall be lay citizens and others with established professional competence in a pertinent discipline, and the following characteristics or attributes may serve as guidelines in making appointments to the Board:

1. Members of the public interested in trees as a major component of Carpinteria's physical and aesthetic environment.

2. Arborists, ornamental horticulturists, and landscape architects and designers, or those with a technical background in a related field. At least two members of the Board shall have such a professional background....

[Carpinteria City Code Section 12.28.080]

There shall be a beautification or tree commission in the city consisting of 7 members, appointed by the mayor, subject to approval of the city council. Their terms of office shall be 3 years and until their successors are appointed and qualified... The members shall serve without compensation, but all necessary expenses shall be paid by appropriate council action.

The city council may remove any appointed member of said commission from office prior to the expiration of their term, with or without cause by an affirmative vote of not less than three-fifths of the members of the city

council. Vacancies on the commission, ... , shall be filled by appointment by the mayor, subject to approval of the city council.

The commission shall hold regular meetings at least once each month, and may hold such addition meetings as it deems necessary. A majority of the commission shall constitute a quorum for the purpose of transacting the business of the commission. The commission shall, as soon as practical after the time of the annual appointment of a member to the commission, elect a chairman, vice-chairman, and a secretary thereof...

The secretary of the commission shall keep a record of all proceedings, resolutions, findings, determinations and transactions of the commission, which records shall be a public record, and a copy of which record shall be filed with the city clerk as clerk of the city council...

[Burlingame City Code Chapter 3.28]

17. Specify cooperation between departments and agencies

Purpose: To require cooperation between municipal departments in matters pertaining to tree resources.

Key elements:
-List of activities that require consultation between departments
-Responsibilities of municipal departments to coordinate activities

Notes: Even with a single designated authority for the urban forest program, it may be helpful to explicitly require that departments and agencies communicate and cooperate in operations that can affect trees.

A. The Public Works Department shall notify the Parks and Recreation Department of any applications for new curb, gutter, sidewalks or driveway installations, or other improvements which might require the removal of or cause injury to any street tree, or interfere with the fulfillment of the street tree plan.

B. Any public utility maintaining any overhead wires or underground pipes or conduits shall obtain permission from the Director before performing any maintenance work on the wires, pipes, or conduits which would cause injury to street trees. The public utility shall in no way injure, deface, prune, or scar any street tree until their plans and procedures have been approved by the Director...

[Modesto City Code Section 12-5.08]

In order to provide for coordination and the maximum feasible use of all public lands, areas and funds, plans and specifications for city street and public area planting proposed by the landscape supervisor shall be submitted to the city engineer, traffic engineer, planning director, and where appropriate, special district directors and managers, for their

recommendations, and such recommendations shall be made within thirty days after receipt of such plans and specifications.

To facilitate the planting and maintenance of trees in new subdivisions, developments, streets and public areas, the planning director shall advise and cooperate with the landscape supervisor in carrying out the provisions of this chapter.

[Camarillo City Code 13.12.080]

18. Develop a comprehensive management plan

Purpose: To develop an integrated management plan for the urban forest.

Key elements:
-Responsibility for developing and updating the comprehensive management plan (if not defined in provision 15)
-Method by which the plan is to be adopted and revised
-List of elements to be included in the plan

Notes: The comprehensive tree management plan is the keystone of any tree program, because it lays out the framework for tree management in the community. Much of the work needed to develop the comprehensive plan will already be completed if the process discussed in Part 1 of this document has been followed. Throughout the entire management plan process, public input and public education should be given high priority.

Authority for developing and implementing the plan should be assigned. Some elements to be considered in the management plan include:

-inventory of existing trees;
-identification of planting sites;
-prioritized planting plan;
-standards for tree selection, siting, planting, and pruning;
-scheduled maintenance for new and established trees;
-inspection program for tree-related problems and hazards;
-guidelines for protecting existing trees from construction-related damage;
-integrated disease and pest management strategies;
-reforestation plans that allow for phased removal and replacement as trees become a liability;
-plans for utilization of waste wood.

Within three years of the adoption of this Ordinance, the Director with the advice and participation of the Tree Board shall adopt an Urban Forest Management Plan. The Division thereafter shall use its best efforts to insure that activities of the Division are guided by such plan. The plan shall incorporate the following elements:

(a) A clear, concise, and comprehensive Statement of Policies and Objectives for urban forestry management in the City, which statement is to be developed by the Director with the advice and participation of the Tree Board through a process of at least three public hearings;

(b) A designation of proposed urban forestry treatments for major traffic routes and districts within the City consistent with the City's Master Plan, together with a program, schedule, and suggested budget for implementing such treatments;

(c) An inventory of every street tree and any other trees deemed necessary by the Division, which inventory shall include, as appropriate, species, age, condition, maintenance records, names of adjacent property owners, record of fees and fines, and any other information necessary or usable in the long-range planning or day-to-day planting and maintenance of the City's urban forest;

(d) A Street-Tree Renewal Plan, based on an evaluation of species characteristics and performance as recorded in the inventory, providing for rotational reforestation of diseased or declining trees and break-up of potentially problematic monocultures;

(e) A set of Standards for the Division, and the public for street-tree installation, landscape-tree installation, pruning and maintenance, acceptable tree species and any other standards, criteria, or administrative procedures deemed necessary to carry out the purposes of this Ordinance and the Urban Forest Management Plan;

(f) A process for continual update and improvement of the Urban Forest Management Plan elements.

[San Francisco Public Works Code Section 806]

19. Resolution of conflicts between trees and structures

Purpose: To set priorities for solving conflicts between trees and street improvements.

Key elements:
-Priority of trees over street improvements (hardscape)
-Responsibility for approving corrective measures

Notes: Tree-related damage to street improvements is common in many communities. Unfortunately, the approach in too many cities has been to remove trees rather than to find a way to deal with street improvements to save trees. This provision can be used to establish the priority of trees over hardscape.

Individual property owners normally do not have the resources or expertise to develop satisfactory solutions to tree-hardscape conflicts on their own. Therefore, the responsibility for correcting conflicts between trees and street improvements should not be assigned to the property owner. However, if the conflict results from actions by a property owner which violate municipal tree planting standards, the city may require the property owner to bear some or all of the cost of corrective action.

A. When roots of a tree planted within the planting area damage city curbs, gutters and sidewalks (including driveway ramps), the city shall be responsible for appropriate corrective measures which are least damaging to the tree.

[San Luis Obispo City Code Section 12.24.150]

Where sidewalk or curb damage due to tree roots occurs, every effort shall be made to correct the problem without removing or damaging the tree. The city forester shall be responsible for developing or approving corrective measures in consultation with the city engineer.

[Example code by the authors]

20. Exemption from Solar Shade Control Act

Purpose: To exempt a local jurisdiction from the provisions of the Solar Shade Control Act.

Notes: The Solar Shade Control Act of 1979 (California Public Resources Code Section 25980 et seq.) prohibits shading of solar collectors that results from tree growth occurring after a solar collector is installed. One problem with this law is that trees which are in place before a solar collector is installed may come to be in violation through further growth. Cities and counties may, by majority vote of the governing body, exempt themselves from the provisions of the act.

The city is exempt from the provisions of Chapter 12 (commencing with Public Resources Code section 25980), Division 15 of the Public Resources Code which chapter is known as the Solar Shade Control Act.

[Carmel-By-The-Sea City Code 12.28.050]

21. Responsibilities of property owners

Purpose: To set forth any responsibilities for maintenance of trees, either public or private, assigned to property owners.

Key elements:
-Designation of responsible parties
-Assignment of responsibilities
-Performance standards for maintenance activities

Notes: In many communities, residents are responsible for some types of tree maintenance, particularly for trees which extend over public rights-of-way. In such cases, it is the responsibility of the municipal tree program to provide information on the types of care to be provided and complete instructions on proper methods. For example, if residents are responsible for tree trimming to maintain clearance for pedestrian and vehicular traffic, standards for clearances and information on proper pruning methods should be readily available to residents.

Even if standards are set and distributed, the municipality may still have little control over the quality of maintenance performed by residents. As an alternative, the municipality may simply require residents to notify the tree program when problems occur, and have work done by municipal crews or contractors. This allows for greater control over the quality of tree maintenance.

(a) It shall be the duty and responsibility of all property owners to maintain the grounds of maintenance strips on the owner's property, regardless of whether such property is developed. This maintenance shall include watering as needed and keeping such strips free from weeds or any obstructions contrary to public safety. Property owners shall be responsible for watering mature city street trees whenever landscaping of the property is changed in such a manner as to deprive the tree of its normal source of moisture. Such watering shall be continued during dry weather until the street tree becomes acclimated to the new environment, but need not exceed three years. All watering requirements shall be waived to the extent they are inconsistent with governmental restrictions on water use.

(b) It shall be the duty and responsibility of every person owning or occupying any real property within the City of Sacramento, to keep all trees on that property trimmed in such a manner that there is a clearance of at least fourteen feet above any street or alley, and a clearance of at least seven feet over any sidewalk. It shall also be the duty and responsibility of every person owning or occupying any real property within the City of Sacramento to keep all trees on that property trimmed in such a manner that they do not obstruct the view of any traffic sign or device for vehicle traffic in the direction controlled by that traffic sign or device.

[Sacramento City Code Section 45.5]

The owner or occupant of any corner lot or premises in the town shall keep trees, hedges and growth at the corners of intersecting streets, whether between the curb line and the private lot line, or within the private lot or premises, so trimmed that the height of the same shall not exceed three feet above the curb level for a distance of thirty feet measured horizontally in any direction from the point of intersection of the property lines at street corners; provided, that trees whose main trunks are exposed to a height of seven and one-half feet above the curb need not be so trimmed or cut.

[Los Gatos Town Code Section 31-15]

The duty is imposed upon a property owner to notify the parks and recreation department when any tree, palm, shrub or plant in a public street adjacent to his property is injuring or damaging any public sidewalk...

[Carlsbad City Code Section 11.12.120]

22. Help for citizens performing tree maintenance

Purpose: To assist citizens in meeting requirements mandated by the local government.

Key elements:
-Types of assistance to be provided
-Method of applying and qualifying for assistance
-Authority charged with granting assistance

Notes: Some street tree ordinances contain a provision which allows the city to assist citizens with street tree maintenance, if the citizen reimburses the city for the work it performs. The following example is typical of such provisions.

> *...On application of any person to whom there has been issued a permit to trim, prune or remove a tree from a City right-of-way, the City Engineer may trim, prune or remove such tree described in such permit provided the cost thereof is paid by the permittee and provided there shall first be deposited with the City Engineer a sum determined to be the estimated cost of such work. All such deposits shall be placed in a trust fund. Following completion of the work the City Engineer shall determine the actual cost of the work and transfer that portion of the deposit to the appropriate City fund and return the balance to the depositor. Should the original deposit be insufficient to cover the actual cost of the work the permittee shall be liable to the City for the unpaid balance and shall promptly pay such amount to the City upon demand of the City Engineer.*
>
> [San Carlos City Code Section 6504]

The City of Visalia's tree ordinance authorizes the Director to require that citizens hire a professional to trim their oak trees. To offset this burden, the city provides financial assistance to help low income residents hire professional tree trimmers. The ordinance creates a special "Oak Maintenance Fund" to finance the assistance program. The fund derives its income from fines and penalties assessed for violations of the tree ordinance.

> *If the Director determines that a property owner who has submitted a Notice of Intent to Prune an Oak Tree, cannot properly prune his or her Oak Tree without the assistance of a professional tree trimmer, and that said property owner cannot afford to hire a professional tree trimmer because he or she does not have the financial resources to pay for such services, the Director may provide financial assistance to said property owner for the purpose of pruning the tree or trees, if the following conditions are met:*
>
> *(a) The property owner uses the property where the tree(s) are located as his or her principal place of residence;*
>
> *(b) The aggregate gross income of all persons eighteen (18) years of age or older residing on the property does not exceed the minimum amount as may be set from time to time, by resolution of the City Council, pursuant to this subdivision; and*
>
> *(c) The Director determines that it is necessary to prune the tree to remove hazardous conditions, remove disease, rot, pests, other harmful conditions, or promote healthy growth of the tree(s).*
>
> *Such financial assistance shall include, but not be limited to, low interest loans, work done by the City with the cost borne in part or in whole by the property owner, work done by the City with the cost borne by the City to be repaid by the property owner upon such terms as the City and property owner shall agree, or any combination thereof.*
>
> [City of Visalia Ordinance Code Section 2349]

23. Topping prohibited

Purpose: To prohibit topping of public and private trees.

Key elements:
-Definition of topping, if not included in provision 4
-Classes of trees covered by the provision

Notes: Topping is the practice of cutting back large diameter branches of a mature tree to stubs. It is a particularly destructive pruning practice. It is stressful to mature trees, and may result in reduced vigor, decline, or even death of the tree. In addition, new branches that form below the cuts are only weakly attached to the tree, and are in danger of splitting out. Topped trees require constant maintenance to prevent this from happening, and it is often impossible to restore the structure of the tree crown after topping.

Unfortunately, many people believe that topping is a proper way to prune a tree, and this destructive practice is very prevalent in some communities. In such cases, a vigorous program of public education should be pursued in combination with the ordinance.

Ordinances that restrict topping may apply to public trees only, or may extend to all trees, both public and private, within the community. For example, the city of San Juan Capistrano has detailed regulations regarding topping. The regulations define topping (as "severe trimming"), prohibit it in certain zoning districts, and describe the type of pruning which is to occur.

Rather than including detailed specifications in the ordinance itself, we recommend that the ordinance authorize the preparation and enforcement of tree pruning standards by the tree program manager (see provisions 15 and 18). This allows for greater flexibility and easier updating of the standards when necessary.

> *..."Severely trimmed" shall mean the cutting of the branches and/or trunk of a tree in a manner which will substantially reduce the overall size of the tree area so as to destroy the existing symmetrical appearance or natural shape of the tree in a manner which results in the removal of main lateral branches leaving the trunk of the tree in a stub appearances as shown is Exhibits A and B...*
> *...No property owner or his agent in the Tourist Commercial, ... or any residential zoning district located within 500 ft of a scenic highway or drive ... shall cause any tree on his property to be severely trimmed ...*
> *...The following standards identify trimming methods which will give maximum benefits to both trees and people:...*
>
> [San Juan Capistrano City Code Section 9-3.625]

24. Permit required for planting trees in the public right-of-way

Purpose: To ensure that street tree selection and placement conforms with municipal standards.

Key elements:
-Permit process for planting in the public right-of-way

-Prohibition of planting in conflict with established standards
-Remedies to be applied in case of violation

Notes: In order to avoid future maintenance problems and sidewalk damage, local governments usually reserve the right to control plantings in the public right-of-way. The tree program manager should be given authority over such plantings in provision 15.

> *No person shall plant any street tree except according to policies, regulations and specifications established pursuant to this chapter...*
>
> [San Luis Obispo City Code Section 12.24.130 F.]

> *All trees planted in the public street or sidewalk area and all tree planting required by this code shall be located and planted under the supervision of the city forester, who shall supervise such planting and locating. In the performance of such work, consideration shall be given to the following factors; provided, that setbacks permit and considerations of safety do not interfere. These factors are determined to be of primary importance in maintaining the city forest.*
>
> *A. Trees that must be removed shall be replaced by new planting, except in unusual circumstances.*
>
> *B. Wherever feasible, trees shall be planted near old and dying ones in anticipation of their removal.*
>
> *C. Unnatural regularity of spacing and arrangement shall be avoided; staggered, or irregular locations or a simulated forest arrangement being preferred.*
>
> *D. Species selected may vary, depending on location; however, the preference of native species is urged; the Monterey pine is to be perpetuated as our dominant forest tree within the city.*
>
> *E. The coordinating of tree planting on public ways with landscaping on private property so as at achieve the above purposes is deemed desirable.*
>
> [Carmel-By-The-Sea City Code Section 12.28.230]

Although some ordinances require removal of any tree planted without a permit, it may be preferable to require removal of only those trees that do not conform with standards. Some jurisdictions will allow nonconforming trees to remain, but require the property owner to accept all financial responsibility for tree maintenance and damage that may be caused by the tree.

> *Whenever any tree is planted or set out in conflict with the provisions of the Article, it shall be lawful for the Parks Superintendent to remove or cause removal of the same. The cost of removal of such tree may be charged to the property owner responsible for the planting thereof.*
>
> [San Buenaventura City Code Section 8421.2]

If one of your goals is to encourage tree planting, the permit process for planting should be as simple as possible, and no permit fee should be charged. A program to educate the public on appropriate tree selection and siting for local conditions is highly recommended to complement this provision. It is more productive to spend time and effort encouraging proper tree selection and planting than removing offending trees.

25. Planting requirements

Purpose: To ensure appropriate tree planting in new developments.

Key elements:
-Performance standards for tree planting and maintenance during establishment
-Designation of responsibility for planting and maintenance
-Protocol to ensure that planting complies with the comprehensive management plan or other standards

Notes: Some communities include tree planting requirements in a separate landscape ordinance. However, in most cases, tree planting requirements are appropriately placed in the tree ordinance.

It is very important that basic performance standards be set in this provision. The provision can specify minimum tree densities (e.g. numbers of trees per street mile) or canopy standards (e.g. amount of shading to be provided within a set period of years). The tree program manager should then be given the latitude to develop appropriate implementation standards and approve specific plans.

> *At least 50% of the paved area surface [of parking areas] shall be shaded by tree canopies within 15 years of acquisition of building permits. Trees to be planted to develop such a canopy shall be in accordance with the City's Master Street Tree Plan and the requirements of the Director of Parks and Trees. Plans submitted to the Development Review Board shall show the estimated tree canopies after 15 years of growth, the specific names, sizes and locations of trees to be planted, and the total area in square feet of the area shaded by tree canopies. In determining the area shaded, the following methodology shall be used:*
>
> *i. Measure the shaded area on the pavement assuming that the shaded area is only that area directly under the tree canopy or dripline.*
>
> *ii. Landscape planters under the canopy may be counted as shaded area.*
>
> *iii. Paved areas shaded by structures (such as second stories of buildings, carports) may be deducted from the total paved area.*
>
> [City of Oroville City Code Section 26-49.k.10)

Responsibility for planting and maintenance varies by community. If developers do not perform the actual planting, they are normally required to pay in-lieu fees and tree planting is handled by the local government.

The building permit approval process is frequently used to ensure compliance with tree planting regulations. Communities may withhold occupancy permits until trees have been satisfactorily installed, and require performance bonds to ensure establishment. Performance bonding should be for *at least* three years to guarantee good long-term survival. Furthermore, unacceptable tree growth or condition, as well as actual tree death, should be grounds for bond forfeiture. Trees that are of poor quality when planted or are maintained poorly may not actually die within three years, but their future survival and performance may still be unacceptable.

No subdivision shall be approved unless it is found to include planting of official, approved street trees within the adjacent parkways in conformity with the Street Tree Management Plan and under the Director's supervision...

In-lieu fees, which are established by resolution of the City Council, may be deposited by the developer or applicant upon the recommendation of the Director. In cases when a subdivision is being approved, and the building process may be over a prolonged period of time, in-lieu fees may be required...

In the event a subdivider desires to plant trees within the parkway adjacent to a new subdivision, he may apply to the Director for a permit. Such permit may be issued by the Director only after the subdivider has posted a a bond pursuant to Chapter 2.17 of this Code, guaranteeing the planting of all street trees, and paid the estimated cost of all irrigation and maintenance for a three-year period. All such planting shall be done in accordance with the Street Tree Master Plan, as shall any necessary replanting which would be required should any of the planted trees die within [or be deemed unacceptable by the Director at the end of] the three-year period.

The costs of planting and the first three years of maintenance, including irrigation, of all street trees in a new subdivision, shall be borne by the subdivider. The Director shall determine the cost involved for each subdivision, which shall be paid to the City prior to City Council approval of the final map of the subdivision. The Director shall plant, maintain, and irrigate such trees at such times and places as the development of the subdivision, its occupants, and other conditions make feasible.

[Carpinteria City Code Section 12.28.160]

B. Before planting, all street trees must be inspected and approved by the city arborist or his designee...

F. So the city arborist can determine the tree requirements for site development, any subdivider or developer shall submit to the city a plot plan of the proposed subdivision which shall:

1. show clearly all existing trees, noting location, species, diameter and condition

2. note whether existing trees will be retained, removed or relocated

3. show proposed utilities, driveways, street tree locations, and the size and species of proposed street trees.

[San Luis Obispo City Code Section 12.24.100]

26. Situations which are declared to be public nuisances

Purpose: To define unacceptable situations which are subject to abatement by the local government.

Notes: Conditions and situations that jeopardize public health and safety are most commonly declared to be public nuisances. Hazardous trees and trees which obstruct travel or line of sight fall into this category.

Situations that threaten the health of the urban forest or are contrary to the community forest management strategy may also be declared nuisances. This second category includes trees which harbor diseases or insect infestations that may readily spread to adjacent trees, and species which are considered undesirable. Improper maintenance practices which can lead to tree death or disfigurement have also been declared to be public nuisances in some communities.

Abatement procedures are typically contained in a separate provision (see provision 27 below).

A. Any tree, shrub or groundcover, growing or standing on private property in such a manner that any portion thereof interferes with any public street, sidewalk, alley or restricts the flow of traffic or visibility of such street, sidewalk, alley or intersection thereof to any person or persons lawfully using such streets, sidewalks, alleys or intersections shall constitute a public nuisance.

[La Habra City Code Section 12.20.100A]

The following things are public nuisances whenever they may be found within the City of Sacramento:

(a) Any living or standing elm tree or part thereof infected to any degree with the Dutch Elm Disease fungus, Ceratocystis ulmi *(Buisman) Moreau; or which harbors any of the elm bark beetles,* Scolytus multistriatus *(Marsh.) or* Hylurgopinus rufipes *(Eich.);*

(b) Any dead elm tree or dead part of any elm tree, including logs, branches, stumps, firewood or other elm material from which the bark has not been removed.

[Sacramento City Code Section 45.102]

It is hereby declared a public nuisance for any person owning, leasing, occupying, or having charge of any premises in the City of Visalia which has one or more Oak trees located thereon to intentionally, negligently, accidentally, or otherwise maintain said premises in such a manner so as to cause harm to and of said Oak trees, by reason of any of the following conditions.

1. Water saturation or deprivation;

2. Nailing, screwing, stapling, bolting, or otherwise attaching boards, fences, signs, placards, posters, or any other material which might cause injury to the Oak tree;

3. Neglect in the pruning or trimming of overgrown, diseased, decaying, dead, or rotting limbs, branches, and foliage.

[City of Visalia Ordinance Code Section 2356]

27. Abatement of hazards and public nuisances

Purpose: To set forth procedures for abating the public nuisances described in provision 26 above.

Key elements:

-Authority to determine nuisance (if not noted in provision 15)
-Procedure for notification and appeal, including time limits
-Method of abatement and assessment of costs incurred

Notes: Communities vary in the detail to which they prescribe the procedures which must be followed for nuisance abatement and assessment of associated costs. Notification and appeal procedures may be simple or involved.

> *... upon a determination by the Park Superintendent that such a private tree constitutes a public nuisance, he shall give written notice to the owner of the property upon which said nuisance exists to trim, remove, or otherwise control such tree in such a manner as will abate such nuisance. Failure to comply with such written notice within ten days thereafter, is a violation of this section...*
>
> [Patterson City Code Section 12.16.120]

> *... The City may remove or trim such tree, may permit any public utility to do so, or may require the property owner to remove or trim such tree on private property or on a public parking strip abutting upon the property of the owner. The failure of the property owner, or his duly authorized agent, to remove such tree after fifteen (15) days notice by the City Superintendent shall be deemed a violation of the provisions of this chapter, and the City Superintendent may then remove or trim such tree and assess the cost thereof against the property.*
>
> [Fowler City Code Section 7-1.08]

28. Licensing of private tree care firms

Purpose: To ensure that firms performing tree maintenance within the jurisdiction are qualified and have appropriate liability insurance coverage.

Key elements:
-Types of tree maintenance that require special licensing
-Requirements for professional qualifications
-Liability insurance requirements
-Method of documentation
-Authorization for license suspension or revocation for violations

Notes: Improperly performed tree maintenance work, including pruning, cabling, and removal, can cause property damage and endanger public health and safety. Therefore, many community tree ordinances require that firms engaged in tree work carry liability insurance.

> *Any person, firm or corporation engaged in the business of removing City trees shall carry public liability and property damage insurance in an amount to be determined by the city council and policies or certificates thereof shall be filed with the city clerk. Where deemed advisable, the Director may require the posting of a performance bond pursuant to Chapter 2.17 of this code to guarantee the completion of any job in accordance with adopted City Standards, rules and regulations.*
>
> [Carpinteria City Code Section 12.28.240]

Furthermore, improper pruning practices can irreparably disfigure and harm trees. In the interest of protecting community tree resources, it is reasonable for the local government to require proof of professional competence from those performing tree work for hire. Such proof might take the form of certification from the International Society of Arboriculture, completion of course work and training in arboriculture, passing an examination, or other criteria.

> *When the city requires tree pruning, any tree service contractor performing work shall have on its staff an arborist certified by the Western Chapter of the International Society of Arboriculture. This arborist must oversee all pruning work and certify that all work meets the city's pruning specifications. If a certified arborist is not on the staff of the tree contractor, the city arborist must approve the tree service contractor before work begins.*
>
> [San Luis Obispo Municipal Code Section 12.24.160]

As in the above examples, many jurisdictions require proof of insurance and professional qualifications only of firms performing work for the local government. In the interest of improving tree care community-wide, such requirements could be extended to all tree service firms operating within the community.

> *Any person engaged in the business of pruning, trimming or removing of trees in the City of Escalon, shall secure an annual permit to so from the City Administrator. This permit is in addition to all other business licenses required by Ordinance No. 24 as amended of the City of Escalon. ... As a condition to obtaining said permit, the person shall furnish satisfactory proof to the City Administrator that he has public liability insurance covering said pruning, trimming, or removing trees, in minimum amounts ... as established by the Council by resolution. The policy or policies of insurance, or certificates thereof, shall be filed with the City Administrator, prior to the issuance of said license, and such person shall keep said insurance in full force and effect during the term of the permit.*
>
> [Escalon City Code Ordinance 147 Section 12]

> *Any person or business performing tree pruning and repair work for hire within the city shall possess a valid tree care license. The city arborist is authorized to issue tree care licenses to persons or businesses that meet the following minimum requirements:*
>
> *1. The person or at least one person on the staff of a business must be designated as a Qualified Arborist by the city. To be designated as a Qualified Arborist, a tree service employee shall demonstrate a knowledge of proper arboricultural techniques by providing documentation of professional certification, education, and/or experience acceptable to the city arborist.*
>
> *2. Certification must be provided that all tree work will be performed under the direct supervision of the Qualified Arborist and will comply with all city standards and ordinances.*
>
> *The city arborist is authorized to suspend or revoke the tree care license of any person or business that performs work which does not comply*

with tree care standards as specified in this chapter and in the comprehensive tree management plan. License suspensions and revocations may be appealed to the city tree commission within 10 days of notification. The decision of the city tree commission shall be final and is not subject to appeal.

[Example code by the authors]

29. Harming public trees forbidden

Purpose: To prohibit negligent or intentional damage to trees and other plants growing in the public right of way.

Key elements:
-Designation of which trees and other plants are protected
-Prohibited activities and actions

Notes: This is one of the most common provisions in street tree ordinances. It is primarily targeted at preventing vandalism and negligent damage. Some ordinances have elaborate lists of many different ways which trees can be harmed. Others include prohibitions against fastening animals to trees and allowing animals to browse trees. Some ordinances extend protection to tree guards or supports as well as to trees.

If damage is properly defined in the definitions section (see provision 4), it may be possible to cover all types of damage rather simply, and avoid long (and often incomplete) litanies of damaging practices. Legal staff should be consulted in this regard.

It shall be a violation of the provisions of this Chapter for any person to abuse, destroy or mutilate any tree, plant or shrub in a public parking strip or any other public place, or to attach or place any rope, wire (other than one used to support a young or broken tree), sign, poster, handbill or other things to or on any tree growing in a public place, or to cause or permit any wire charged with electricity to be placed or attached to any such tree, or allow any gaseous, liquid or solid substance which [is] harmful to such trees to come in contact with their roots, [trunks,] or leaves.

[Corcoran City Code Section 2-4-9]

30. Permit required to remove or prune city owned trees

Purpose: To provide for municipal review and approval of any activity which could be detrimental to public trees.

Key elements:
-Activities that require a permit
-Position with authority to issue permits (if not noted in provision 15)
-Guidelines for approving or denying permits, including conditions that may be required to prevent or compensate for damage
-Permit application and appeal procedures, including time limits

Notes: In order to safeguard the public investment in street trees and other public trees, many local governments reserve the right to

regulate a variety of potentially damaging activities. The authority to approve regulated activities should normally be vested with the tree program manager.

Each community needs to decide what activities it will regulate. Some of the activities that might require a permit include:

- tree removal,
- pruning,
- grading or trenching near trees,
- installation of pavement over tree rootzones,
- transport of buildings or other large items which could break city street tree branches.

To prevent a net loss of trees, all trees removed should be replaced in a manner consistent with the overall tree management plan. If a community's goals include conservation of tree resources and establishment of maximum canopy cover, guidelines for approving tree removal permits should clearly establish the precedence of trees over hardscape or turf (see also provision 19).

A. No person, unless expressly authorized hereunder, shall plant, remove, cut, trim, or prune, any street tree or any tree, plant, or shrub in a city park or other public place without a permit issued by the Director of Public Works. Such permit application shall be made at least 2 working days before the intended activity. The Director of Public Works may grant the permit or grant a permit on conditions when such is consistent with the provisions of this chapter, the Master Street Tree Plan, and other applicable laws and public policy. No such permit shall be valid for a period greater than 30 days after the date of its issuance.

B. In the case of moving a building along a street, such permit conditions may include rerouting, segmenting of such structure, and payment by applicant of attendant costs attributed to trimming or cutting authorized under such permit.

[Pasadena Municipal Code Section 8.52.080]

(a) The director shall issue permits to property owners to perform maintenance on or to remove city street trees, only if the following conditions are met:

(1) The property owner has established, to the director's satisfaction, that there is need for the proposed work on the tree; and

(2) The property owner has established, to the director's satisfaction, that the persons who are to perform the work are qualified to do so; and

(3) The director, in his sole discretion, has determined that any potential detriment to the city street tree population entailed by the proposed work, is justified in the individual case. In making this determination, the director shall consider factors such as the probability that the proposed work will destroy or seriously injure the tree, the tree's health, the desirability of that species as a street tree, whether the tree's condition and size threaten serious damage to property, the condition and number of other city street trees in the vicinity, whether there are other less onerous means of accomplishing the applicant's goals, and other related criteria.

(b) All work performed on city street trees pursuant to a permit issued by the director under this section shall be done within a sixty day period from the issuance of said permit, or within such longer period as the director shall specify.

(c) The director shall condition any permit granted pursuant to this section for the removal of a city street tree, on the permittee removing, and where the director determines to it be appropriate, replacing the tree. In such case, the full cost of removal and replacement shall be borne by the owner and such service shall not be provided by the city.

(d) The director may condition any permit granted pursuant to this section on any such conditions as the director determines to be necessary.

(e) The provisions of Sec. 45.12 shall be complied with whenever a property owner seeks a permit to remove or trim a city street tree to facilitate moving any building or other structure.

[Sacramento City Code Section 45.7]

As part of the procedure for granting tree removal permits, some communities require that a notice be posted or published in the newspaper.

The city shall post a sign notifying the public of the date and description of a proposed tree removal. The sign shall be posted in a prominent location, visible from a public street, for a period not less than five days before either staff consideration of a tree removal permit or a public hearing on a related development.

[City of San Luis Obispo Code Municipal Code Section 12.24.180F]

In some communities, local public utilities may be given a yearly permit that allows them to prune public street trees. In such cases, the local government should set minimum pruning standards and provide for inspection to enforce these standards.

When maintaining street trees, a public utility must observe good arboricultural practices, as specified by the International Society of Arboriculture Western Chapter Pruning Standards and the City of San Luis Obispo Safety Pruning Specifications.

[San Luis Obispo Municipal Code Section 12.24.140]

...Public utility companies subject to the jurisdiction of the California Public Utilities Commission may perform such pruning as is necessary to comply with the safety regulations of said commission and to maintain a safe operation of their facilities without a permit. However, they shall notify the planning department at least three working days (except in emergencies) prior to taking any action. The planning director shall cause such pruning work to be inspected, when appropriate, to insure that good pruning practices previously reference are followed. The planning director shall have the authority to stop any tree-pruning performed by a utility if such practices are not being followed...

[Corte Madera City Code Section 15.50.040]

31. Permit required to remove or prune protected private trees

Purpose: To limit indiscriminate removal of, and damage to, trees on private property.

Key elements:
-Classes of trees protected
-Activities subject to regulation
-Standards for approving regulated activities
-Permit process, including requirements, fees, time limits, and appeals
-Conditions or compensation required to offset adverse impacts

Notes: This type of provision is typically known as a heritage or landmark tree protection provision. This type of provision is best suited to protecting conspicuous *individual trees* that are of unique historical, ecological, or aesthetic value, and therefore constitute an important community resource. However, since the life spans of individual trees are limited, especially in the urban environment, this type of provision does not address the long-term sustainability of the urban forest. Furthermore, because of its focus on individual trees, this type of provision may not be appropriate for, or effective at, protecting woodlands and forests. Woodland or forest conservation is addressed in provision 32.

Regulated trees and activities

Private tree protection regulations are commonly directed toward oaks or other native or historical trees. Protected trees are typically designated by species and size or size alone. Diameter at 4.5 ft above ground level (also known as diameter at breast height or DBH) is usually used as the measure of tree size. One disadvantage of using a size criterion is that some property owners may elect to remove trees before they grow large enough to come under the protection of the ordinance. This is obviously a counterproductive situation, since it has the effect of destroying future tree resources. Unfortunately, this behavior has been observed in some California communities. If the goal of the community is to protect large numbers of small diameter trees, a forest/woodland protection provision (see provision 32) may be more appropriate.

In many jurisdictions, the tree permit system is tied to the issuance of construction permits and protection is provided only during construction. In this case, continued tree protection after construction is not guaranteed, unless addressed by other provisions.

> Scope - *The provisions of this chapter shall apply to all mature native oak trees, historic trees and mature trees, where those tree are associated with proposals for urban development, on all public and private property within the City of Simi Valley, except as specified in Section 9-1.1509.*
>
> [City of Simi Valley Municipal Code Section 9-1.1502]

Some communities extend protection to trees whether or not construction is involved. In the following example, a permit is required to perform any activity that may damage protected trees.

Such a provision will clearly require a high level of community support and voluntary compliance to be successful.

Many tree protection provisions provide specific exceptions that are not covered by the ordinance. The intended meanings of words such as "cut", "remove", "encroach", "protected zone" and "oak tree", should be defined in the definitions section (see provision 4). In this example, "cut" includes pruning.

> *a) No person shall cut, remove, encroach in the protected zone, or relocate any oak tree on any public or private property within the City unless a valid oak tree permit has been issued by the City pursuant to the provisions of this chapter and the Oak Tree Preservation and Protection Guidelines. The status of limbs or trees as deadwood or dead trees must be confirmed buy the City's Oak Tree Preservation Consultant.*
>
> *b) Exemptions. A permit is not required to cut or remove a tree(s) under the following circumstances:*
>
> *(1) Trees that do not exceed two inches (2") in diameter when measured at a point four and a half feet (4.5') above the tree's natural grade.*
>
> *(2) Trees damaged by thunderstorms, windstorms, floods, earthquakes, fires or other natural disasters and determined to be dangerous by a peace officer, fireman, civil defense official or code enforcement officer in their official capacity. The Department of Planning and Community Development shall be promptly notified of the nature of the emergency and action taken.*
>
> *(3) When removal is determined necessary by fire department personnel actively engaged in fighting a fire.*
>
> *(4) Trees planted, grown and/or held for sale as part of a licensed nursery business. This exemption is limited to trees with main trunks under ten inches (10") in diameter.*
>
> [Thousand Oaks Municipal Code Section 5-14.04]

Rather than requiring a permit for pruning, the city of Visalia requires filing of an "intent to prune notice". The purpose of this provision is to avert improper pruning of oak trees (see also provision 22):

> *Except in cases of emergencies as described in Section 2344, no person shall prune or cause to be pruned any Oak Tree limb of a diameter of 2" or greater within the City of Visalia without first submitting a completed Oak Tree Intent To Prune Notice with the Director, as provided herein.*
>
> [City of Visalia Ordinance Code Section 2345]

Standards for approving regulated activities

The standards or criteria for approving tree removal or damage may vary somewhat between locations, due to the predominant tree species present or other site-specific details. The following examples list most of the criteria which are commonly included.

The intended decision of the Director shall be based upon reasonable standards, including, but not limited to, the following:

(a) The condition of the Oak Tree with respect to its general health, damage, status as a public nuisance, danger of falling, proximity to existing or proposed structures, interface with utility services, and its status as host for [parasitic] plant[s], pest[s], or disease[s] endangering other species of trees or plants with infection or infestations.

(b) The necessity of the requested action to allow construction of improvements or otherwise allow economic or other reasonable enjoyment of property.

(c) The topography of the land and the effect of the requested action on soil retention, water retention, and diversion or increased flow of surface water

(d) The number, species, size and location of existing trees in the area and the effect of the requested action on shade areas, air pollution, historic values, scenic beauty, and the general welfare of the City as a whole.

(e) Good forestry practices such as, but not limited to, the number of healthy trees a given parcel of land will support.

[City of Visalia Ordinance Code Section 2342]

...The determination of the approving body in granting or denying a permit shall be based upon, but not limited to, the following:

...The approximate age of the tree relative to its average life span;

...The effect of removal on soil erosion and stability, particularly near streams and steep slopes;

...Present and future visual screening potential;

Any other information the Body finds pertinent to the decision including, if necessary, information obtained at a public hearing;...

[Kirkwood Tree Ordinance, Alpine County]

Permit process requirements

Permit applicants are normally required to provide the information necessary to decide if the proposed action meets the established standards for approval. Depending upon the standards, this may include plot maps, data on tree size and condition, and the anticipated visual or environmental effects of removal. Many cities have standard forms listing the types of information to be submitted.

Some communities exempt their municipal departments from the permit process, although this is not the case in the following example. Requiring city departments to meet the same requirements as private property owners assures more uniform implementation, and may provide beneficial public relations value as well.

Any person desiring to cut, move or remove a tree or protected tree within the city of Belmont shall apply to the Superintendent for a permit. A permit is not required for pruning as herein defined.

The application for the permit shall be made on the form provided by the Superintendent for this purpose and shall include the number, location and type(s) of the tree(s) to be cut, moved or removed and the reason for such action. The applicant may submit an arborist's report or other expert evidence for consideration. The application shall be

> *accompanied by any required fee to cover the cost of processing as set in the current City fee schedule. Fees shall be waived for applications made by a department of the City of Belmont on its own behalf.*
>
> [Belmont City Code Section 25-5]

While permit fees are normally collected from developers, some communities do not charge fees to homeowners who are required to get permits for pruning or removing private trees. This may help boost voluntary compliance, since homeowners may incur various costs simply to meet requirements for the permit application.

Many provisions which regulate tree removal during development require a report by a qualified professional on the condition of the trees. The professional may either be the city arborist or a qualified outside consultant. To minimize conflict of interest situations, the consultants should be responsible to, and paid by, the local government, which in turn recovers the charges from the applicant.

> *The permitting authority may also require the applicant to submit a tree condition report prepared by a qualified tree expert selected and retained by the City. The applicant shall reimburse the City for all costs related to the preparation of the report.*
>
> [Example text by the authors]

Some communities also include in this section a requirement that prior to removal, the tree be posted with a notice stating that the tree will be removed within a specified time, and describing the appeals process. Others, as in the following example, require public notification before a permit is granted.

> *In the case of removal of any heritage tree...the director shall not act on such an application until a hearing is held thereon. Notice of the time and place of the hearing shall be posted in a conspicuous place on the real property upon which the heritage tree is located and shall be mailed to the applicant and all owners of real property within a five hundred (500) foot radius of the real property upon which the heritage tree is located...*
>
> [Sacramento City Code Section 45.217]

<u>Conditions and compensation required for approval</u>

Some tree protection ordinances include specifics on how trees are to be protected during construction. However, since such details are technical and potentially changeable, it is best not to include them in the ordinance. The provision should authorize the tree program manager to prepare, enforce, evaluate, and revise the actual specifications for tree protection. Although some communities have developed quite extensive tree protection guidelines, it should be realized that even highly detailed guidelines cannot substitute for a case-by-case analysis by a qualified professional.

Some communities require that performance bonds be posted for trees that are to be retained, so that developers are held accountable for damage that occurs during construction. However, such bonding should take account of the fact that damage inflicted to tree roots is not readily visible, and that above ground symptoms

associated with root damage may take years to become obvious. A long bonding period, preferably 5 years or more, should be used, since the mere presence of trees on a site shortly after construction does not signify that the trees are undamaged. Performance bonds should not be released if retained trees show a significant decline in vigor or condition. In order to document changes in tree condition, tree ratings should be made prior to construction and at the end of the bonding period.

When adverse impacts to protected trees cannot be avoided, compensation is usually required. Most commonly, this takes the form of direct on- or off-site replacement, or payment of a designated amount into a special fund earmarked for acquiring trees. A formula for calculating the value of trees removed or injured provides a good basis to determine the required compensation. It is preferable to set basic standards for replacement in the ordinance, but leave technical details to the discretion of the tree program manager. Specifying details, such as the size of replacement stock to be used, may result in inappropriate plant material selection.

> *The conditions may be imposed on the permit at the discretion of the decisionmaker including, but not limited to, any of the following:*
>
> *(a) A condition requiring the replacement or placement of additional trees on the subject property to offset the impacts associated with the loss of a tree, limbs or encroachment into the protected zone of an oak tree;*
>
> *(b) ...the planting of new tree[s] off-site to offset the loss of a tree;*
>
> *(c) A condition requiring an objectively observable maintenance and care program be initiated to insure the continued health and care of oak tree(s) on the property.*
>
> *(d) Payment of a fee or donation of [planting stock] to the City or other public agency to be used elsewhere in the community should a suitable replacement location of the tree not be possible on-site or off-site.*
>
> [Thousand Oaks Municipal Code Section 5-14.06]

Provisions which regulate private trees are unlikely to be effective without community support. Unless residents strongly support tree protection, it is probably advisable to link tree protection with some sort of benefit or incentive to balance the additional burden imposed by the provision. The local government might provide tree care assistance, consulting, reduce certain assessments, or institute a recognition program to provide a tangible benefit to owners of protected private trees. Education and incentive programs are needed to ensure that protected trees are seen as an asset rather than a liability.

If your community is interested in preserving native trees, you may want to consider options beyond limiting tree removal on private property. For example, you might consider a policy which calls for planting native trees in public places (see provisions 7, 24, 25).

32. Conservation of forest and woodland resources during development

Purpose: To promote the conservation of functional forests and woodlands on private lands during development.

Key elements:
-Types of woodland or forest land subject to regulation
-Activities regulated on lands covered with woodlands or forests
-Performance standards for conservation of woodland or forest resources
-Criteria for assessing, conditioning, and approving regulated activities
-Permit process, including requirements, fees, time limits, and appeals

Notes: The purpose of this provision is to provide a means for conserving woodlands and forests. At minimum, conservation of these resources requires that:

-natural stands or groups of trees are given priority over individual specimens;
-activities that fragment the woodland into small units are minimized;
-meaningful standards for tree retention and reforestation are set;
-provisions are made for regeneration of the woodland;
-components of forests and woodlands other than trees are taken into consideration.

Provisions for woodland protection have not been used widely in California to date. Instead, some communities have attempted to use individual tree protection provisions (provision 31) to protect woodlands, primarily by lowering the minimum diameter for tree protection. However, these tree protection provisions usually lack the necessary features noted above, and as a result, they often do not provide for satisfactory woodland or forest conservation.

Regulated lands and activities

All properties with significant forest or woodland resources should be subject to the provision. The ordinance should define what is considered to be forest or woodland, as is done in the example below. Forest or woodland types of special local concern could be specifically noted in this section. In many parts of California, wooded lands have been converted to agricultural use prior to a second conversion to urban development. If a community has the goal of restoring lost or degraded woodlands and forests, lands that have the potential for supporting forests or woodlands could be included under the provision.

Establishing the resource base line is a potential source of problems for virtually all resource conservation ordinances. Unscrupulous individuals sometimes destroy or alter much of the resource prior to development in an attempt to avoid conservation requirements in the development process. To encourage good resource stewardship prior to development, historical aerial photos could be used to establish the forest resource base line.

This provision shall apply to all unincorporated lands within the jurisdiction for which approval for a discretionary project is requested and for which either of the following conditions apply:

A. Parcels having canopy cover by native trees or other woody vegetation of at least 10% as of (month/year), as determined from base line aerial photography dated (date) on file with the Planning Division.

B. Parcels that currently support or historically supported native trees or other woody vegetation but were used for agricultural crops or pasture at the time of the aforementioned base line aerial photography.

The approving authority shall be authorized to determine whether the provisions of this ordinance apply to any specific parcel. The burden of proof that the provision should not be applied to a specific parcel shall be on the property owner.

[Example code by the authors]

Activities regulated through the permit process should include any that could potentially degrade the woodland. This would include activities such as clearing the understory, or altering watercourses.

Except as provided for herein, no person or corporation shall destroy or significantly alter any forest or woodland through tree damage or removal, clearing, grading, tilling, burning, application of chemicals, or any other means unless they possess a valid Woodland Alteration Permit. No person or corporation shall be granted a permit for subdivision, grading, building, or the construction of any improvement on wooded or forested lands unless they possess a valid Woodland Alteration Permit. Any alteration of wooded or forested lands shall conform to the conditions and specifications of the Woodland Alteration Permit.

[Example code by the authors]

On tracts of commercial timberland greater than three acres, the Forest Practice Act (California Public Resources Code Section 4511 et seq.) may apply and would take precedence over local ordinances. As amended, this act does not allow individual counties to adopt rules or regulations that are stricter than those provided for by the act. However, counties may recommend that the Board of Forestry adopt additional rules and regulations to account for local needs.

Performance standards for woodland conservation on regulated lands

Standards for tree retention and reforestation will vary with the types of woodlands or forests involved. Canopy cover and/or stocking rates (trees per unit area) are probably the most widely applicable ways of expressing these standards. In general, any type of development will result in more canopy loss in areas with high levels of canopy cover than in areas with low canopy cover. Therefore, it may be desirable to establish standards for canopy retention that vary with the base line level of canopy. In the example text, two standards are used to provide for a smooth transition between the different retention levels. Foresters or other resource professionals should be consulted to help establish meaningful and appropriate standards.

The canopy cover base line could be used to set both retention and reforestation standards. Parcels showing an increase in tree cover beyond the base line could be allowed greater flexibility when developed. Parcels showing a loss in tree cover could be required to restock the woodland to acceptable levels before development could occur. This strategy would help provide a strong disincentive for clearing prior to development. Property owners would protect their future options best by maintaining or increasing tree cover on their lands.

In the first example below, viable stands of trees are given priority over individual trees. However, protection for individual trees of special concern could also be obtained through provisions of a landmark tree provision (provision 31). If properly constructed, tree protection and woodland conservation provisions can complement each other to provide for more complete management of existing tree resources.

Canopy retention standards. The following table shall be used to determine the minimum amounts of woodland canopy that must be retained during development on wooded lands. Canopy cover may be determined using any method acceptable to the approving authority.

	Canopy retention standard shall be the greater of Column A or Column B:	
Base line canopy cover	*Column A*	*Column B*
80-100%	*.75 x base line canopy cover*	*65% canopy*
60-79%	*.80 x base line canopy cover*	*51% canopy*
40-59%	*.85 x base line canopy cover*	*36% canopy*
20-39%	*.90 x base line canopy cover*	*19% canopy*
19% or less	*1.0 x base line canopy cover*	--

Example: For 50% base line canopy, the minimum allowable canopy after development would be the greater of Column A (.85 x 50% = 42.5% canopy) or Column B (36% canopy). In this case, the minimum allowable canopy after development would be 42.5%.

Retention standards shall be applied to retain stands of trees and undisturbed woodlands in priority over individual specimen trees which will be incorporated into the development. No more than 10% of the canopy retention standard may be met by individual trees not included within designated woodlands.

Reforestation standards. In areas where tree removal, clearing, fire, or any other intentional or accidental canopy reduction has resulted in canopy levels below the base line level, the standard for reforestation shall be set at 100% of base line levels, except that no reforestation standard shall exceed 85% nor be less than 15% canopy cover.

[Example code by the authors]

Removal of oak trees in the areas outside of the North County Area Plan, ... shall be allowed only if the following purposes and standards are satisfied...

B. Standards:

1. The current Best Management Practices as promulgated by the University of California [Integrated] Hardwood Range Management [Program] shall be followed to maintain and promote regeneration of oak trees.

2. A representative sample of sizes, ages and species of oaks shall be retained with special emphasis placed on retaining saplings.

3. The number of oaks on any acre shall not be reduced to less than 25% canopy existing at the time of the adoption of this ordinance.

4. Removal of oak trees encroaching on existing cultivated farmland is allowed.

[Monterey County Code Section 16.60.050B]

Criteria for approving regulated activities

The criteria for approving woodland alteration should be clearly stated in the ordinance.

Requirements for approving Woodland Alteration Permits. Issuance of a Woodland Alteration Permit is contingent upon the following requirements:

1. A Woodland Conservation Plan for the subject property must be approved by the approving authority.

2. The level of canopy removal requested must not exceed that provided for in the Canopy Retention Standards.

3. All reforestation plantings required as a condition of approval must be installed at least one year prior to the issuance of the Woodland Alteration Permit, and must be approved as adequate after inspection by the approving authority.

4. All other requirements pursuant to county ordinances, the California Environmental Quality Act (CEQA), and other applicable local, state, and federal laws and regulations must be fulfilled.

[Example code by the authors]

1. Removal of more than three protected trees on a lot in a one year shall require a Forest Management Plan and approval of a Use Permit by the Monterey County Planning Commission.

2. The Forest Management Plan shall be prepared by a qualified professional forester, as selected from the county's list of Consulting Foresters. Plan preparation shall be at the applicant's expense.

[Monterey County Code Section 16.60.040C]

Conditions and mitigation required for approval

Whenever development occurs around sensitive natural resources, the primary goal should be to avoid adverse impacts through a sensitive development plan. To promote woodland conservation, the plan should strive to maintain groups of trees in contiguous areas that function as a cohesive habitat. Development patterns that cluster development on a portion of the overall project area and leave wooded areas as dedicated open space provide one means for maintaining functional woodlands.

Compensatory mitigation should only be considered after all reasonable efforts have been made to minimize loss. Reforestation on- or off-site is one form of compensation, but a newly-planted forest or woodland does not provide the habitat value of a mature stand. While reforestation should be promoted for long-term resource conservation, suitable mitigation of short-term impacts can best be obtained by requiring that equivalent quantities of developable land be reserved from development. Such woodland reserves should remain undeveloped at least until reforested areas attain the habitat value of woodlands which were lost. It may be desirable to target certain critical areas for acquisition as permanent forest/woodland reserves through this process of "mitigation banking".

Woodland Conservation Plan. The purpose of the Woodland Conservation Plan (WCP) is to establish specific methods to conserve existing and potential woodland resources during development. The WCP shall be prepared by a qualified natural resources consultant retained by the county, and the charges of preparing the WCP shall be borne by the applicant.

The WCP shall provide that a project meets the Retention and Reforestation Standards of this provision through any, or a combination, of the following methods or other methods acceptable to the approving authority.

1. Minimizing the extent of the development and siting it to avoid impacts on existing woodlands.

2. Clustering development on a portion of the project area to retain continuous stands of trees in the nondeveloped portion. Transfers of development density from nondeveloped portions of the project area may be allowed only if nondeveloped portions meet the criteria for developable land.

3. Providing for reforestation of equivalent sites within or outside of the project area that will not be subject to future development. Where reforestation is used to replace existing woodlands removed for development, estimated canopy cover 20 years after planting shall be used to calculate the equivalent canopy cover provided.

4. Public acquisition of title to or permanent conservation easements on developable lands with equivalent woodland resources located outside of the project area. Total area, canopy cover, woodland type, and habitat value shall be considered in determining whether off-site resources are equivalent to those of the project site.

Methods that protect and enhance existing woodlands shall be given precedence over those that restore non-wooded lands. Protection of woodlands within the project area shall be given precedence over off-site acquisition. The location of off-site mitigation areas is subject to the approval of the approving authority.

[Example code by the authors]

CEQA

The California Environmental Quality Act (CEQA) provides another possible avenue for addressing woodland protection. It may be useful to include provisions that clearly indicate under what circumstances an Environmental Impact Report (EIR) is required. This

may require two steps. First, the provision should state under what circumstances tree removal or woodland alteration will be considered a "project" under CEQA and thus subject to review. Second, the provision can set specific thresholds for loss or disturbance of woodlands and forests that would be considered "significant" under CEQA, and therefore require the preparation of an EIR. Requiring the preparation of an EIR above a certain threshold may help dissuade applicants from automatically requesting the maximum amount of clearing provided for in the retention standards.

> *All tree removal requests coming under this subsection shall be subject to the requirements of the California Environmental Quality Act (CEQA).*
>
> [Monterey County Code Section 16.60.040C]

> *CEQA compliance. The proposed removal or disturbance of woodlands to the maximum extent allowed under the Retention Standards shall require the preparation of an Environmental Impact Report (EIR). Based upon the specific characteristics of the site under consideration, the approving authority may also determine that lesser amounts of woodland removal or alteration pose a significant adverse impact and require the preparation of an EIR.*
>
> [Example code by the authors]

Permit process requirements

Permit applicants are normally required to provide the information necessary to decide if the proposed action meets the established standards for approval. This section should clearly indicate the general classes of information to be submitted with the permit application. The community forester or approving authority should be authorized to prescribe the specifics of the type and format of required information. Types of information that might be requested include base line information on the status of the resource before development, and information on the proposed changes and their expected impacts. This should include data on all components of the woodland, including tree resources, understory vegetation, wildlife, soils, and hydrology.

> *The Director of Planning and Building Inspection shall prescribe the format and content requirements for the Forest Management Plan and maintain a list of qualified and acceptable foresters to prepare the Forest Management Plan.*
>
> [Monterey County Code Section 16.60.040C]

View or solar access ordinance provisions

The following set of provisions can be used as a guide for drafting an ordinance to facilitate the resolution of conflicts between citizens that pertain to trees on private property (Goal 9, page 17). The provisions covering this goal may be included in the tree ordinance or enacted as a separate ordinance. If tree dispute resolution provisions are included within the tree ordinance, it will be necessary to include appropriate references in provisions 3, 4, 10, 11, and 15. If a separate tree dispute ordinance is developed, these provisions will need to be included in the ordinance.

On the left side of the page is an explanation of the purpose of each ordinance provision, a list of its key elements, and notes on its use and implications. Example text for the ordinance provision is shown on the right side of the page and is taken, wherever possible, from ordinances presently in use in California. Example text is provided for illustration, and may need to be modified or replaced with language that is suited to meet local needs.

33. Procedures to be followed in resolving tree disputes

Purpose: To set forth procedures to be followed in resolving disputes over alleged obstruction of views or sunlight by trees.

Key elements:
-Procedure for notifying the tree owner of the complaint
-Procedure for resolving the claim
-Position(s) responsible for hearing claims

Notes: When the tree owner is a private person, the procedure for resolving the complaint usually involves a series of steps. The procedure is initiated by notifying the tree owner of the complaint in writing. The complaining party and the tree owner may then attempt to resolve the conflict informally in face-to-face meetings or through the use of a mediator. If this is unsuccessful, a formal procedure for mediating the dispute is initiated.

Some jurisdictions require a public hearing before a city committee in the event that private reconciliation or mediation fails to resolve the dispute. In this case, the findings of the committee may be subject to appeal. In other jurisdictions, binding arbitration is an option. No appeals are allowed if binding arbitration is elected.

Responsibility for hearing disputes should be designated. If a committee, such as a community tree board already exists, this could be one of its responsibilities. If a new committee needs to be constituted to settle disputes, its makeup should be specified in the provision.

A claimant who believes in good faith that the growth, maintenance or location of trees situated on the property of another diminishes the beneficial use, or economic value of his or her property because the tree interferes with the access to sunlight or views naturally accruing to the property, shall notify the tree owner in writing of these concerns. The notification should, if possible, be accompanied by personal discussions to enable the complaining party and tree owner to attempt to reach a mutually agreeable solution.

[San Francisco Public Works Code Section 823(a)]

> *A. Where the initial reconciliation attempt fails, the claimant shall propose mediation as a means to settle the dispute on a relatively informal basis. Acceptance of mediation by the tree owner shall be voluntary. If mediation is elected, the parties shall mutually agree upon a tree mediator. ... The tree mediator shall not have the power to issue binding orders for restorative action, but shall strive to enable the parties to resolve their dispute at this stage by written agreement in order to eliminate the need for a hearing before the Tree Commission or for litigation.*
>
> *B. Where the initial reconciliation process fails and where mediation has not resolved the dispute, the claimant and the tree owner shall be subject to the findings and order of the commission following a noticed hearing...*
>
> [El Cerrito City Code Section 10.50.150]

When the city is the owner of the tree in dispute, a more streamlined procedure can be used. This procedure essentially calls for assessment of the validity of the claim in light of the standards in provision 34.

> *A claimant who believes in good faith that the growth, maintenance or location of trees situated on City property diminishes the beneficial use, economic value, sunlight, or the enjoyment of views naturally accruing to the claimant's property, may apply to the City on a form approved by the Public Works Director....All view claims found by the City to be valid shall be subject to restorative action...*
>
> [Sausalito City Code Section 11.12.040D]

34. Standards for resolution of tree disputes

Purpose: To establish standards to judge tree dispute claims.

Key elements:
-Documentation to be submitted by the complaining party
-Standards for evaluating views
-Standards for assessing the degree of view obstruction
-Standards for judging the positive and negative aspects of corrective action
-Considerations for selecting restorative action

Notes: The complaining party is generally required to demonstrate that view obstruction did not exist at the time they acquired the property. The claimant is also required to demonstrate that the burdens imposed by the tree outweigh the benefits that the tree provides.

To minimize the negative impacts on the trees involved, some ordinances specify a hierarchy of potential corrective actions. Tree removal and topping should be discouraged, and less drastic steps should be used whenever possible.

In adjucating all disputes, unless otherwise specifically provided, the provisions of this chapter are to be utilized to resolve view claim disputes.

A. The claimant has no right greater than that which existed at the time of the claimant's acquisition of the property involved in the view claim and shall provide evidence to prove the extent of that original view and right.

B. The character of a view shall be determined by evaluating:

1. The vantage point from which the view is obtained;

2. The existence of landmarks or other unique features in the view; and

3. The extent to which the view is diminished by factors other than the tree(s) involved in the claim...

C. The existence and character of the view obstruction shall be determined by evaluating:

1. The extent of the alleged view obstruction, expressed as a percentage of the total view, and calculated by means of a surveyor's transit or by photography or both; and

2. The extent to which landmarks or other unique features in the view are obstructed.

[El Cerrito City Code Section 10.20.130]

In resolving the tree dispute, the tree arbitrator or court shall consider the benefits and burdens derived from the alleged obstruction within the framework of the purposes of this Article as set forth is Section 821 in determining what restorative actions, if any, are appropriate. In proposing any given restorative action the complaining party shall have the burden of proving that the burdens posed by the tree owner's trees outweigh the benefits provide by the trees with respect to the proposed restorative action.

(a) Burdens.

(1) The hazard posed by a tree to persons or structures on the property of the complaining party including, but not limited to, fire danger and the danger of falling limbs or trees.

(2) The extent to which the tree diminishes the amount of sunlight available to the garden or home of the complaining party.

(3) The extent to which the tree interferes with efficient operation of a complaining party's pre-existing solar energy system...

(b) Benefits.

(1) Visual quality of the tree, including but not limited to, species characteristics, size, growth, form, and vigor.

(2) Location with respect to overall appearance, design, and/or use of the tree owner's property.

(3) Soil stability provided by the tree considering soil structure, degree of slope, and extent of the tree's root system...

[San Francisco Public Works Code Section 824]

Any restorative action shall be evaluated based on the standards of this article and consideration of the following:

(1) The effectiveness of the restorative action in reducing the view obstruction....

[Contra Costa County Code Section 816-2.612]

All restorative actions shall be undertaken subject to the following:

1. Restorative actions must be consistent with all applicable statutes, ordinances and regulations.

2. Where possible, restorative actions shall be limited to the trimming and/or thinning of branches; but, when such is not a feasible solution, windowing is the preferable solution...

[El Cerrito City Ordinance Section 10.50.130G]

35. Apportionment of tree dispute resolution costs

Purpose: To establish a method for assigning costs associated with the dispute resolution process and restorative actions.

Notes: The method by which costs are assigned should be specified for both private party disputes and private party-city disputes. Generally, the claimant is assigned the greater share of the associated costs, and may bear all costs if the claim is rejected.

... The costs of all mandated restorative actions and/or replacement plantings shall be apportioned between the claimant and the tree owner as mutually agreed to, or in the absence of agreement as follows: ...

[El Cerrito City Code Section 10.50.150C(2)]

(a) The complaining party and the tree owner shall each pay 50 percent of the costs of the arbitrator's personal fee, if any.

(b) The complaining party shall pay 100 percent of both parties' reasonable attorneys' fees in the event that his or her claim is finally denied, or no action is ordered pursuant to Section 824(c). In all other cases the complaining party and the tree owner shall each pay his or her attorney's fees. Court costs shall be allocated to the parties at the court's discretion.

[San Francisco Public Works Code Section 825]

36. Recording for notification of future owners

Purpose: To provide notice to future property owners of limitations on the property associated with a tree dispute resolution.

Any final decision of the tree commission or the City Council, in the case of an appeal, which provides for limitations on the property of a tree owner shall be recorded so that record notice of the decision is given to successors in interest of the tree owner's property.

[El Cerrito City Code Section 10.50.202]

37. Enforcement of tree dispute resolutions

Purpose: To describe methods for enforcing the tree dispute resolution process.

Key elements:
-Legal classification of violations
-Descriptions of available enforcement options

Notes: The local government may choose to enforce the tree resolution process through its police power, or it may establish the process as "self-enforcing". In the latter case, enforcement is normally provided through civil legal action initiated by the complaining party.

Violations of this chapter are not misdemeanors or infractions. Enforcement of this chapter shall be by the involved private parties. Any claimant may seek to enforce any restorative action mandated pursuant to this chapter through ordinary legal proceedings.

[Contra Costa County Code Section 816-2.1004]

Failure or refusal of any person to comply with a final decision under this Chapter or to comply with any provision of this Chapter shall constitute a misdemeanor and shall be punishable by a fine of $1,000 or six months in County Jail, or both. Failure or refusal of any person to comply with a final decision under this Chapter shall further constitute a public nuisance which may be abated in accordance with the procedure contained in Chapter 8.24 of the Title...

[Rolling Hills City Code Section 8.32.070]

Part 3. Evaluating ordinance performance

As noted in Part 1, two stages in the urban forest planning process require the use of evaluation methods. To answer the questions "What do you have?" and "Are you getting what you want?", you will need to evaluate tree resources, management activities, and public attitudes. Thus, evaluation methods are important tools for formulating and monitoring tree management strategies.

In this section, we discuss how various methods and techniques can be used to evaluate tree resources and community forest management. Evaluation methods appropriate to individual management goals are discussed below. More detailed descriptions of each evaluation method are presented starting on page 64.

Evaluating progress toward tree management goals

Nine management goals for community forestry programs are discussed in Part 1 of this document (see page 12). Appropriate methods for evaluating progress toward each of these goals are noted below. If your community has established goals other than those listed here, you will need to decide on the best means for assessing progress toward those goals. Many of the methods discussed in this section are applicable to evaluating other specific goals.

1. Establish and maintain maximum tree cover.

Evaluation methods: ground survey, photogrammetry

The extent of the urban forest can be quantified by determining the percentage of the land area covered by tree canopies. By periodically measuring canopy cover, it is possible to assess the effectiveness of ordinances and other management methods aimed at maintaining or increasing canopy cover.

Canopy cover can be measured directly, through photogrammetry (measurement from aerial photographs) or ground surveys. These methods are relatively easy to use, and do not necessarily require expensive equipment.

Tree density, the number of trees per unit area, is indirectly related to tree canopy cover. Tree density can also be used to estimate tree cover, if the average canopy spread per tree is known.

2. Maintain trees in a healthy condition through good cultural practices.

Evaluation methods: ground survey, record keeping

Progress toward this goal can be evaluated by assessing tree health over time. Community tree inventories that include health ratings may contain all of the data necessary for evaluating this goal. Otherwise, sample plots can be established to obtain data on tree health and/or improper or prohibited cultural practices. For example, jurisdictions that prohibit topping might survey specifically to determine the incidence of this particular problem.

3. Establish and maintain an optimal level of age and species diversity.

Evaluation methods: ground survey, record keeping

In order to evaluate progress toward this goal, information is needed on the distribution of tree species and age classes within the urban forest. This information should be available in most tree inventories. In communities without tree inventories, this information can be obtained through a ground survey. Accurately determining tree age may not be possible, but for the purposes of evaluation, it will usually suffice to group trees into broad age classes.

4. Promote conservation of tree resources.

Evaluation methods: photogrammetry, photo points, ground survey, record keeping

If the approach used to attain this goal involves tree protection or "preservation", it will be necessary to have information on the long-term survival and condition of individual trees. If woodland or forest conservation techniques are applied, the extent, composition, and condition of stands of trees should be documented. Both aerial and ground level photography provide a simple means for documenting the presence and condition of individual trees and stands of trees over time. Ground survey methods and inventory data can also be used to provide more detailed base line data against which changes can be measured.

5. Select, situate, and maintain street trees appropriately to minimize hazard, nuisance, hardscape damage, and maintenance costs.

Evaluation methods: ground survey, record keeping

Information about the types of tree/site combinations that result in high maintenance costs or damage is used to evaluate progress toward this goal. Ground surveys can be conducted to determine what types of tree/site combinations are associated with current maintenance and damage problems. Most or all of this information may already be on hand in cities with tree inventories that track tree maintenance. Costs of hazardous tree removals, tree-related sidewalk repairs, and maintenance should be tallied by the types of tree species and planting situations where they are incurred. In the absence of good historical records, ground surveys can be conducted to determine what types of tree/site combinations are associated with current maintenance and damage problems.

Once these relationships are established, they can be used as a basis to evaluate current tree selection, siting, and maintenance practices. The evaluation should be repeated periodically to account for changes that result as new species and planting methods are adopted, and as trees planted at different times mature.

6. Centralize tree management under a person with the necessary expertise.

Evaluation method: record keeping

Municipal records of tree-related permits and maintenance can provide the data to show whether this goal is being realized. If tree management is truly centralized, these records should show that all activities that may affect community tree resources have been reviewed and approved by the municipal arborist or forester.

7. Promote efficient and cost-effective management of the urban forest.

Evaluation method: record keeping

Records on costs and the types of operations performed are used to determine the cost-effectiveness and efficiency of the urban forest management program. An accounting of labor and materials expenses should be maintained, preferably broken down by the types of activities performed, such as tree planting, pruning, and removal. In addition, it is important to keep track of the time devoted to other aspects of the tree management program. Activities such as

planning, ordinance enforcement, research, public outreach, and education, are all important to urban forest management. An evaluation that neglected these aspects would be incomplete.

8. Foster community support for the local urban forestry program and encourage good tree management on privately-owned properties.

Evaluation methods: public polling, ground survey, photogrammetry

There are two distinct aspects to this goal, so evaluating progress requires two different types of methods. The first aspect involves changing the way that people think about the urban forest. Public opinion polling methods provide the best means to measure changes in public attitudes and knowledge. The process of assessing public attitudes can also serve an educational function in itself, by helping to keep urban forestry issues in the public eye.

Beyond determining what people think, it is also necessary to know if new knowledge or attitudes are translated into action. For instance, if a city decides to use public education to discourage tree removal on private property, it is not enough to know whether public attitudes about this practice have changed. Success is measured by the degree to which changed attitudes result in a decreased incidence of tree removal. This requires the use of survey techniques that measure the extent of tree resources on private lands over time.

9. Facilitate the resolution of tree-related conflicts between citizens.

Evaluation methods: record keeping, public polling

The effectiveness of the conflict resolution process is the primary issue in evaluating progress toward this goal. The first question to be answered is whether the process is being utilized to resolve tree-related disputes. This information can be easily obtained from records filed through the system that is established.

Assuming that the process is being used, the next question is whether the process works. This question has to be answered by those who have used the process. Extreme care must be taken to separate reactions to the *outcome* of the process from reactions to the process itself. It is not reasonable to expect that all parties involved in conflicts will be entirely happy with the eventual resolution. However, if the process is serving its purpose, participants should perceive it as useful and helpful.

Evaluation methods and examples

Some basic tools and ideas for evaluating the effectiveness of tree management approaches are presented below. Included in this section are methods for evaluating tree resources, urban forestry management activities, and public attitudes. Most of the techniques summarized here are well established, although a few new applications and adaptations for urban forestry are included. Where possible, examples are given to demonstrate an actual application of the techniques described.

The key to successful and efficient evaluation lies in focusing on what needs to be evaluated. It is generally not desirable to collect more detailed information than is likely to be used, since cost and effort generally increase with the level of detail. The process outlined in Part 1 should help you determine what types of data you will need to collect.

A few words on sampling

Many of the techniques described below involve collecting information from or about discrete units, such as trees, streets, blocks, or residents. In many cases, it may not be practical to perform a complete census of every unit in the overall population. However, it is still possible to glean information about the overall population by collecting data from a representative subset or *sample*. The key to this process is ensuring that the sample is representative of the whole population, or *unbiased*. Sampling is simply the technique used to choose representative units for study from a larger population. Sampling is a prerequisite of several of the assessment methods noted below, including photogrammetry, ground survey, and public polling.

Most statistical methods are based on the assumption of *random sampling*. This simply means that every unit in the population has an equal chance of being chosen for the sample. Furthermore, the selection of random units should be independent of other units that have been sampled. If you reject a sample unit because you think it is too close to one already chosen, your sample will not be random and independent.

In many urban forestry applications, it is desirable to have samples distributed throughout the population. For instance, you may want to ensure that trees from each of several different maintenance districts are included in the sample. In such situations, *stratified random sampling* will be the most efficient and meaningful method for selecting samples. In this method, the population to be sampled is first divided into meaningful subunits or *strata*. These may be large subdivisions, planning sectors, maintenance districts, or any other convenient management or planning unit. If strata are assigned so that each is more or less homogeneous with respect to the characters being measured, fewer samples will be needed to adequately characterize each stratum. For instance, if tree cover is to be assessed in different portions of a city, visual estimates of the tree canopy cover could be used to help demarcate zones where canopy cover is relatively uniform.

Once strata are assigned, samples are drawn at random from within each stratum. A relatively simple and reliable method for randomization is to use random numbers. Published random number tables can be found in most elementary statistics texts. In addition, many spreadsheet programs that run on personal computers have functions that generate random numbers. If the number of samples selected from each stratum is not proportional to the size of the stratum, then the averages from each will have to be weighted to obtain an overall population average.

Optimal sample size will vary somewhat with the characteristics being rated or tallied. In general:

- up to a point, the reliability of estimates will increase as sample size increases;
- the more variable the population is with respect to the characteristic(s) being rated, the larger the sample should be;
- a larger sample is required to accurately estimate the frequencies of a relatively rare characteristics.

The optimum sample size represents a compromise between cost and accuracy, since both generally increase with increasing sample size. Optimization is obtained by identifying the point of diminishing returns beyond which further increases in accuracy are not worth the additional costs required. Optimum sample size will vary with the type of data being collected, so it is not possible to set a single number for all applications. Further information about sampling is discussed below under the individual techniques.

PHOTOGRAMMETRY

Use: Measuring tree canopy cover and tree density. From these values, rates of tree survival and removal can also be determined.

Materials:

- Large scale aerial photographs. Ideally, photographs should be taken during early summer, when deciduous trees are in full leaf. The plane of photography should be parallel to the ground surface. Black and white, monoscopic photographs are suitable for canopy measurements. Relatively large scale photographs (about 1:5,000 or less) are the easiest to use, since they can be used without magnification. Photographic scales of 1:14,000 or more may be usable with magnification if resolution is good, but the precision of cover estimates will be reduced.
- Dot grids and/or clear ruler.
- Recommended: light box, hand tally counters.

Notes: While ground surveys can also be used to quantify canopy cover, photogrammetry has several distinct advantages over ground surveys:

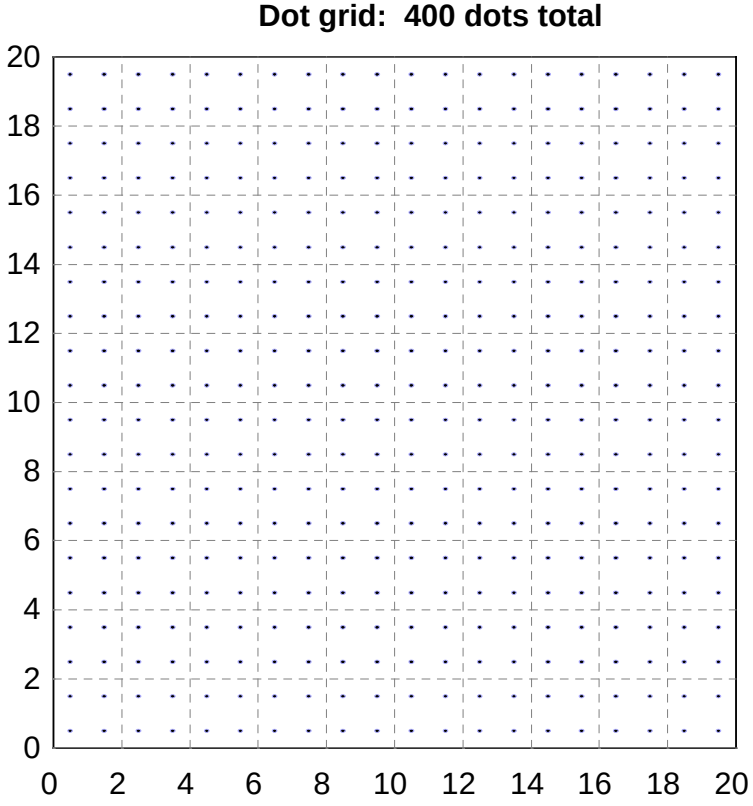
- large areas can be measured at low cost;
- it is the only practical means of surveying areas with limited access;
- aerial photography coverage is already available in many municipalities;

-photographs provide a permanent record that can be reviewed or remeasured as necessary.

Coupled with other aerial photo interpretation techniques, photogrammetry can also be used to map the distribution of various tree species or forest types. It can also be used to monitor tree removal and mortality. However, the level of detail that can be discerned about individual trees from aerial photos is limited, and ground survey techniques are preferred when detailed condition data about individual trees is necessary.

Dot grid method of canopy estimation. This is an easy and accurate method for determining canopy cover, and is equally applicable to natural woodlands and planted urban forests. A dot grid is a sheet of transparent material imprinted with dots arranged in a regular grid. Dot grids can be purchased from forestry suppliers or one can be prepared by photocopying the dot grid on this page onto transparency material.

The dot grid is laid over the area to be sampled and the number of dots that fall on tree crowns is counted. The dots are easier to resolve if a light box is used under the photo. The following formula is then used to calculate percent crown cover:



% crown cover = 100 x (dots falling on trees/total number of dots)

Using this method, we estimate the canopy cover in the 1:2,400 aerial photos shown on pages 62 and 67 to be 21% and 10%, respectively.

Measurement of street tree canopy cover. Based on our review of existing methods and experimentation, we recommend canopy cover at the edge of pavement (CCEP) as a standard for assessing street tree canopy. CCEP can be measured on almost all types of roads. Furthermore, CCEP values are related to the amount of shading that streets receive, and the "canopied" effect that is obtained when trees arch over streets.

To measure CCEP, a single row of dots or a finely divided ruler is lined up along the edge of the pavement, and the number of dots or ruler divisions that fall on tree crowns is counted. Percent crown cover is calculated as noted above in the dot grid method. While this method is easiest to apply on relatively straight sections of road, it is possible to apply the method on moderately curved roads by using a flexible plastic rule held on edge.

On very curved roads and those with very low or high canopy cover, the *line intercept method* may be more efficient than the dot counting method. In this method, the lengths of all tree canopies that intersect the line of the edge of pavement are totaled. Lengths of curved lines may be measured with a planimeter or digitizer. The CCEP is calculated using the following formula:

% CCEP = 100 x (length covered by trees/total length of sample)

Sampling considerations. For most situations, areas to be measured should be selected through stratified random sampling, as discussed under "A few words on sampling" above. Once strata are assigned, the actual *plot* or area to be estimated with the dot grid is chosen randomly. An easy way to do this is to establish a coordinate system based on the length and width of the area to be sampled. A random number table or random number generator is then used to pick the starting location of each plot.

For example, on a large aerial photo 55 cm wide and 81 cm long, the random number pair 35 and 68 would place a sample point 35 cm from the left edge and 68 cm from the bottom.

It is also easier to relocate a given plot if a coordinate system is used to assign plots. If canopy cover is to be compared over time, it may be advantageous to establish *permanent plots* that can be relocated and remeasured in earlier or later photographs. These plots can be inconspicuously marked on the photograph by making a pinhole at the plot starting point. Alternatively, plots might be started at the nearest road intersection to the random point, so that only a list of the intersection names need be retained.

The accuracy of estimates obtained with a dot grid or line will be improved by taking the average of several estimates on each plot. For each estimate, the grid or line should be repositioned randomly. The values from multiple estimates can also be used to compute a standard deviation, which provides a measure of the precision of the estimate.

Example: *Overall canopy estimates*

The City of Riverside has two complete sets of aerial photographs covering the entire city on file in the Planning Department. The older set was photographed in 1974, and the newer set was taken in 1988. Both sets are printed at 1:2,400 (1 inch = 200 feet). This photography constitutes a valuable resource for documenting the extent of the urban forest and changes that have occurred over 14 years.

Using the dot grid method, we rated the overall canopy cover on five randomly selected plots in an established residential area on the 1974 photographs. The same plots were relocated and rated in the 1988 photos. Estimated canopy cover averaged 22.3% in 1974 and 22.7% in 1988, an insignificant change. This level of canopy cover may represent the maximum that will be obtained with the current plantings and management practices in the sampled area.

GROUND SURVEY

Use: Measurement of various tree characteristics, including species, age, size, health, and damage factors.

Materials:

-Map of areas to be sampled
-Data sheets
-Hand tally counters (especially useful for keeping counts in windshield surveys)

Notes: The ground survey is one of the most basic methods for gathering urban forestry data. Ground surveys typically are used to gather the base line data for most tree inventories. However, when resources are insufficient to conduct a complete inventory, a representative sample of the urban forest can often provide sufficient information for making management decisions and monitoring progress. Furthermore, when natural woodlands or forests are managed, as in parks and open spaces, a complete inventory is usually unnecessary and impractical.

The ground surveys used in urban forestry are of two general types, commonly referred to as *windshield surveys* and *foot surveys*. Details of each type are discussed below.

The windshield survey. This technique is most suitable when the data to be collected consist of one to a few obvious characteristics. It is also useful for rating characteristics that occur at relatively low frequencies. While one person drives, the data are tallied by one or more evaluators using tally counters or data sheets. Data collected should consist only of counts of trees that have or lack a particular characteristic or fall into a limited number of categories. The greatest advantage of this method is that it is relatively fast and inexpensive. The main drawback is that only a few characteristics can be rated for each tree. If an evaluator attempts to rate too many characteristics from a moving vehicle, either accuracy will suffer or the driver will have to slow the rate of travel to an impractical speed. The foot survey should be used if a number of detailed observations are to be made on each tree.

Examples of some of the characteristics that could be rated in a windshield survey include:

-Canopy dieback. This is a simple indicator of tree health. Either tally trees above and below a given cutoff value (e.g. dieback affecting more than 1/3 of the crown), or use 3 to 4 categories (e.g. low, moderate, severe, tree dead). If descriptors such as "low" or "severe" are to be used, it is necessary to establish specific criteria for each description (e.g. low=less than 20% of crown affected) to minimize differences that may arise between different evaluators. Photographs that illustrate the different classes are very useful to ensure uniformity between different evaluators and different years.

-Improper pruning practices. Topping and other poor pruning practices are especially obvious in winter after leaf fall.

-Prohibited practices, such as vandalism, or attaching signs or wires to trees.

-Specific disease and pest problems. If surveys are timed to coincide with periods when disease or insect pest problems are most obvious, it may be relatively easy to document the extent and incidence of the problem. For example, leafy mistletoe in deciduous trees is easily rated in the winter months, whereas branch dieback in alder caused by flatheaded borers is most obvious in summer.

-Tree type. Trees can be placed into relatively broad categories based on height or type (e.g. conifers, evergreen hardwoods, deciduous hardwoods) fairly readily. However, more detailed data, such as categorization by species, may require highly trained evaluators, especially in areas where a wide variety of tree species are used.

-Trunk diameter. For many, though not all tree species, diameter serves as a useful indicator of tree age. Several broad classes of tree diameters (e.g. less than 6 inches, 6-24 inches, greater than 24 inches) can be distinguished with enough accuracy to be used in a windshield survey.

-Planting site characteristics. Empty planting spaces, sidewalk displacement, and other obvious site characteristics can be tallied.

Example: *Tree topping incidence*

Some cities prohibit tree topping in order to maintain trees in good health and a safe condition. Before deciding to enact such a provision or adopt other management actions, a community would do well to first determine how prevalent this undesirable practice is.

We conducted a preliminary windshield survey to determine the incidence of tree topping in residential areas of the City of Vacaville. Twelve sample plots were established using randomly-generated coordinates as described under "Photogrammetry" above. From the intersection nearest to each random point, a predetermined route was traveled for a distance of about one-half mile, which generally allowed at least 40 trees to be tallied. For mature hardwood trees in front and side yards, we tallied the total number of trees with and without evidence of topping.

Rating the 12 plots took a little over an hour. In all, 681 trees were tallied, of which 26% (180) had been topped at some point. The incidence of topping varied widely between neighborhoods, ranging from 0 to 53%. Although topping was not tallied by species, it was obvious that Modesto ash and fruitless mulberry were topped most frequently.

Our preliminary sample did not include enough areas of the city to provide a reliable estimate for topping incidence city-wide, but clearly shows that the magnitude of the problem is significant. Based on a more complete sample, the city might consider a variety of options including educational programs, a phased tree-replacement program, tree selection guidelines, and an anti-topping provision. By comparing the base line percentage of topped trees before action with levels in subsequent years, the city could determine whether the actions taken were effective.

The foot survey. When detailed information in a number of different categories is to be collected, the survey should be conducted on foot. All of the examples listed above under the windshield survey could also be evaluated in a foot survey. Some data may be expressed as categories, as in the windshield survey, but it is also possible to take actual measurements rather than make estimates. Hazardous trees and hardscape damage can be inspected and evaluated more thoroughly in the foot survey than in the windshield survey.

Canopy cover estimates. In addition to the applications noted above, the foot survey can also be used to obtain estimates of canopy cover, particularly canopy cover at the edge of pavement (CCEP). To estimate CCEP in a foot survey, the evaluator walks along the edge of the pavement. At evenly spaced points, e.g. every 5 steps or an appropriate distance measured with a pedometer, the evaluator notes whether canopy is present directly over the point at the edge of the pavement. The percent CCEP is calculated using the following formula:

% CCEP = 100 x (points with canopy cover/total number of points)

One advantage of measuring CCEP as part of a ground survey is that it allows one to examine correlations between CCEP and other characteristics. The level of CCEP can be affected by tree species selection, tree age, planting position, and pruning practices, and it may be of use to know which factors are the most important in your community.

Example: *Street tree canopy*

Percent canopy cover was measured in two different subdivisions in the City of Vacaville, one completed in about 1950 and the other completed in 1975. Canopy cover at edge of pavement (CCEP) was measured from 1:2,400 aerial photography taken in 1973 and 1980, 1:1,200 aerial photography taken in 1978, and by ground survey in 1990 along typical residential streets in these areas. The change in CCEP is shown below:

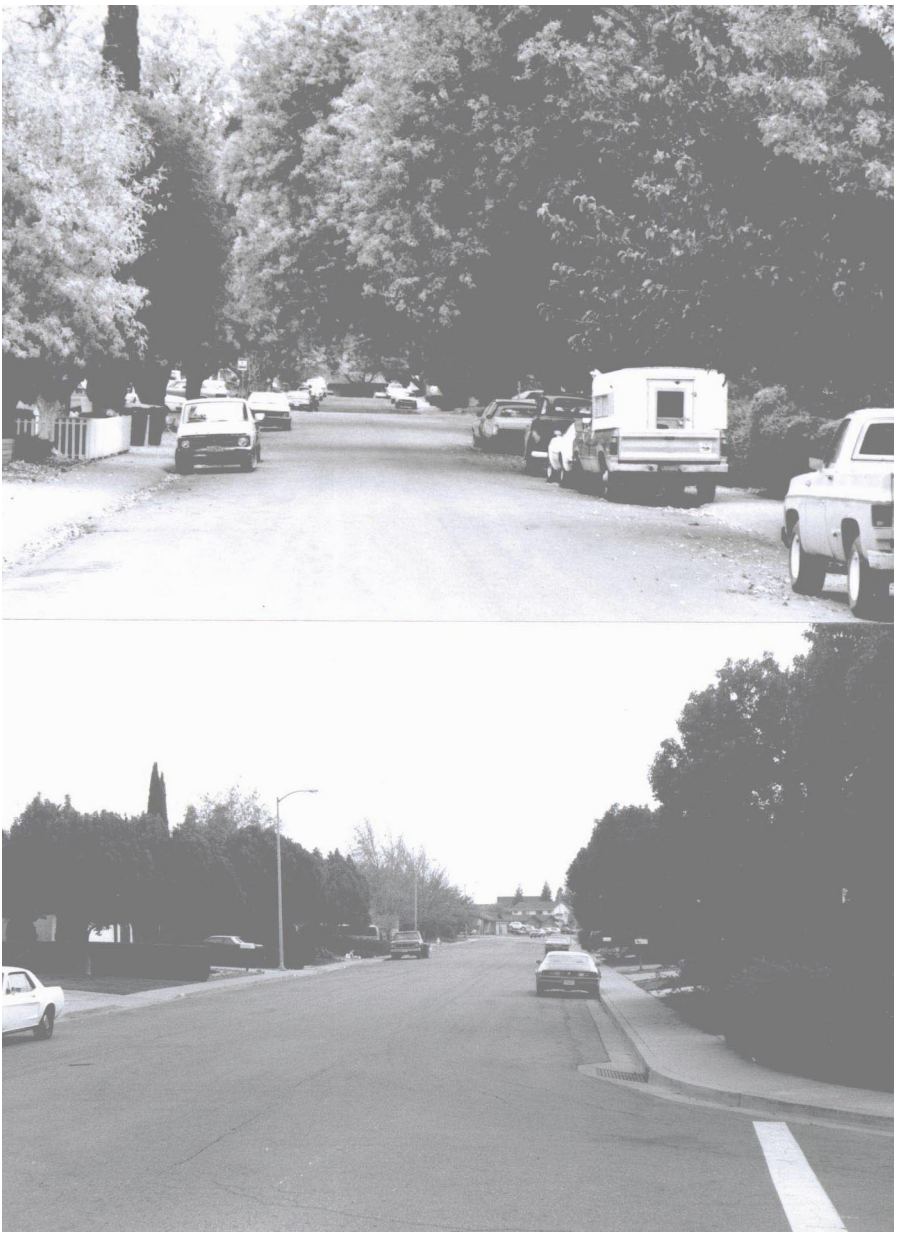
Subdivision completed in 1950:

Year	Years after development	CCEP
1973	23	33%
1978	28	37%
1980	30	37%
1990	40	34%

Subdivision completed in 1975:

Year	Years after development	CCEP
1978	3	0%
1990	15	8%

Such data could be used to evaluate the effect of changes in street tree selection and siting guidelines between 1950 and 1975, or as the basis for targeting tree planting programs. Observations from the ground survey indicate that the rate of canopy increase has leveled off in the 1950's subdivision for two reasons: many trees have reached their mature spread, and the potential spread of other trees has been limited by repeated tree topping.



Sampling considerations. If less than a complete survey is planned, plot selection should proceed as outlined under "A few words on sampling". To provide estimates of size and condition characteristics of street trees, researchers working in several cities in the eastern U.S. (Valentine et al 1978) arrived at the following recommendations, which can be used as a rough rule of thumb for planning ground surveys:

1. Sample 50 to 100 randomly-selected streets (plots). Plots may consist of two to three city blocks.
2. A total of 100 trees of each species or class of trees being studied should be represented in the overall totals.
3. For the most common tree species, a predetermined sampling interval should be used to keep the total number of sampled trees down to 100 or so.

The use of a sampling interval is not strictly necessary, but reduces the amount of effort involved. To use a sampling interval, some information about tree species incidence is required in advance. As an example, suppose you plan to sample 50 plots, and Modesto ash is likely to occur in almost all plots. To have 100 Modesto ash trees represented in the overall sample, it will only be necessary to tally two or three per plot. If you anticipate that ten Modesto ash trees will occur in a typical street section, then only one out of every five Modesto ash needs to be tallied. Finally, the sampling interval needs to be taken into account when the data are tabulated, to show the actual incidence of these tree species.

PHOTO POINTS

Use: Monitoring the growth, condition, and survival of individual trees or groups of trees over extended time intervals.

Materials:

-Suitable record book or data file for keeping photo point information over many years.

Ground-level plots

-A 35 mm camera and color slide film are probably the most versatile. A short focal length lens (about 35 to 70 mm) is preferred. Images from very wide-angle lenses (shorter focal lengths) may have too much distortion, and telephoto lenses (longer focal lengths) may not have a wide enough field of view to be practical.

-Tripod to ensure that serial photographs are taken from the same elevation and angle. A small bubble level and a protractor attached to the tripod head can be used to duplicate photo angles more accurately.

-A magnetic compass to align the angle of the camera in the horizontal plane.

-Maps to note the location of the camera and the photo plot.

-Permanent survey markers, although not strictly necessary, may be useful for marking the exact camera location.

Aerial plots

-Aerial photographs of a given area taken over a period of years. Photographs should be about 1:5,000 or larger scale. Preferably all photographs in the series should be taken or printed at the same scale, and taken at the same time of year.

Notes: A *photo point* is a location from which a specific field of view can be relocated and rephotographed repeatedly. Changes in the tree population at a given site are easily seen by examining a series of photographs taken from a photo point over a period of years.

Ground level photo point. There are two major considerations in establishing an effective photo point. First, trees and other features which are to be documented should be clearly visible at the time the original photo is taken as well as in future photographs. It is advisable to situate the camera well away from vegetation that might subsequently block the view. Views across vacant lots which might later be built upon should likewise be avoided. Perspective should also be considered in composing photos. Empty planting spaces along a street are easier to see in a view that looks across rather than down the street.

Second, it is desirable to duplicate the original camera view in later photographs as precisely as possible. The best match will be obtained if the camera location and angle, and the time of day and time of year are duplicated in later photographs. Therefore, careful notes should be taken at the time of the original photo. The location of the camera can be referenced to permanent landmarks, such as property lines, intersections, fire hydrants, and the like. A survey marker or other permanent

monument may be installed at the camera location to facilitate relocation. Notes should also be taken on the height of the camera and its angle above or below level. A compass bearing should be taken to establish the direction of the photo in the horizontal plane. The type of lens, focal length setting (if a zoom lens is used), date, and photographer should also be noted for future reference.

In some cases, historical photographs may already be available, but the actual location of the camera is unknown. With a copy of the photo in hand, it is often possible to establish a new photo point that closely matches the original angle. This may be easier to accomplish using a camera with a zoom lens. Once the new point is established, the data described above for new points should be noted so that subsequent photos can be taken from the same point.

Ground level photo points are limited by the area that can be effectively shown in each photo. They are likely to be less effective for dense stands of trees and areas with many tall buildings. In some cases, these limitations can be overcome by getting a higher vantage point, such as from the top of a hill or building. In other situations, aerial photo points may be necessary to allow adequate monitoring.

One application of this technique would be for monitoring the effectiveness of tree protection and preservation during development or new construction. Well-situated photographs taken before, during, and after construction can be used to document and monitor both short and long-term impacts. Trees damaged during construction and development may not show serious symptoms until five or ten years later. Strategically situated photo points can clearly show whether protected trees have subsequently declined or been removed.

Aerial photo points. An aerial photo point is simply a variation of the use of aerial photography described earlier. Permanent plots are established based on easily recognizable features such as roads, buildings, utility corridors, or landforms, so that the same area can be compared in successive photographs. Photographs should be printed at the same scale to facilitate direct comparisons. Transparent overlays can then be used to pinpoint the location of specific trees in different photographs.

RECORD KEEPING

Use: Evaluating various aspects of urban forest management, including effectiveness, efficiency, and coordination.

Materials:

-Record keeping materials, such as files, record books, maps, and computers with database or geographic information system (GIS) software. Actual materials will vary with the type of records kept.

-For tree inventories especially, specialized computer software is recommended.

Notes: Record keeping systems may be simple or intricate. Tree programs with a few limited goals will require a limited number of records to evaluate their success. On the other hand, comprehensive tree programs may need to keep more detailed records, and a more extensive record management system will be needed. Fortunately, advances in computer technology have made it easy to store and manipulate large amounts of data with relatively inexpensive personal computers.

Comprehensive tree inventory systems, as discussed below, can provide a wealth of information about the urban forest and municipal tree care operations. However, additional records are normally required to cover such aspects of the tree management program as long-term planning, public education, ordinance enforcement, and program administration. For example, tabulations of tree-related permits, ordinance violations, and enforcement actions may be needed to assess the implementation of certain tree ordinance provisions.

Tree inventory systems. Tree inventories are commonly used to store information about intensively-managed trees, especially those along streets and in parks. The most basic tree

inventories are simply lists of the locations and descriptions of individual trees. More advanced inventories include information on site characteristics, past maintenance, and anticipated maintenance needs for each tree. Complete inventories provide a direct means for assessing the relationship between trees, planting locations, and maintenance expenditures.

The types of information included in the inventory should reflect the goals of the ordinance and the overall tree management strategy. Some of the variables which may be evaluated are as follows:

Trees: species, diameter, height, canopy spread, age or age estimate, remaining life expectancy, condition with respect to health and structural integrity, value;

Sites: location coded by street address or distance along street, planting site specifications (e.g. 3 ft tree well, 4 ft parkway, in lawn 7 ft from sidewalk), proximity to above- or below-ground utilities, potential for replanting if empty, soil type, known soil limitations (e.g. persistent soil-borne diseases such as *Armillaria*, high salt or boron levels, low water-holding capacity, poor drainage);

Cultural practices: past cultural inputs by date of action including planting, fertilization, pruning, cabling, pest control, removal; presence of maintenance problems by date observed, including sidewalk damage, limb breakage, severe disease or insect attack; resident inquiries or complaints; projected maintenance needs and priority;

Costs: materials costs, equipment use, and personnel hours incurred for each cultural operation by date.

Computerized tree inventories are widely used in California. Experience to date indicates that in-house or custom-designed programs are most likely to meet the specialized needs of a community (Bernhardt and Swiecki 1989), although commercial tree inventory software is also available. The use of geographic information system (GIS) software has become much more widespread in recent years. Municipalities using these systems may be able to layer tree inventory data into an existing GIS.

Example: *Street tree management*

The City of Cypress provides an example of how record keeping can be used to evaluate and adjust tree management practices. The city implemented a computerized tree inventory system in 1971 that included detailed work records for each tree. In 1981, they compiled data from the inventory database to determine which trees and planting situations were causing the most damage to concrete curbs and sidewalks. This information was used to adjust the tree management program in several ways. Improved tree selection guidelines were developed to obtain better compatibility between the trees and planting sites. The data were also used to predict locations where future damage was most likely to occur. These areas were targeted for a phased removal program, in order to head off future problems without an abrupt removal of the entire street tree canopy. Finally, a tree ordinance was adopted that provided the authorization needed for the city to control street tree planting, maintenance, and removal.

PUBLIC POLLING

Use: Evaluating public attitudes and knowledge about trees and urban forest management.

Materials: Varies with the type of survey being conducted. See discussion below.

Notes: The use of polling or surveying to assess public opinions, attitudes, beliefs, and knowledge is well known to most people. On almost any day, one can find a newspaper account on the results of a poll or survey on some pressing topic. Polling can be useful in assessing the knowledge and attitudes of the community with respect to urban forestry issues. Properly designed polls can also be used to evaluate whether an ordinance, educational program, or other management activity has brought about changes in knowledge, attitudes, and practices in the community.

Information is normally gathered from the public either through interviews or self-completed questionnaires.

Interviews. Compared with questionnaires, interviews generally have greater flexibility, tend to elicit a higher response rate, and allow for more precise selection of respondents. However, persons conducting interviews need to be carefully trained to avoid introducing bias into the data.

Interviews may be conducted either in person or by telephone. Telephone interviews are less expensive to conduct, allow for better sampling designs, and can be used in conjunction with computers. Computer-assisted telephone interviewing (CATI) systems are a relatively recent development that increase the efficiency of telephone interviews. A CATI system can be used to help the interviewer adjust their questions based on information obtained during the interview, and allows for the direct entry of data as the interview proceeds.

Self-completed questionnaires. Self-completed questionnaires have the advantage of being easier to administer than interviews. Questionnaires are most commonly sent and returned by mail. Respondents have more opportunity to think about questions or look up information for a self-completed questionnaire than in an interview.

Typically, prior to the main survey mailing, the questionnaire is pretested on a small sample. Any problems that are identified in the construction of the questionnaire can then be corrected.

Several techniques are commonly employed to boost the return rate for mail surveys. These include the use of advance notification, attractive first-class stamps rather than bulk postage, hand addressing, postage-paid return envelopes, carefully-timed reminder postcards, and repeat mailings of the questionnaire to nonrespondents. Token incentives included with the survey are sometimes used to increase the return rate, but these will also increase survey costs. Incentives may also introduce bias into the returns if they tend to motivate some groups more than others.

Survey design considerations. Much of the difference in cost between the various methods is related to the logistics of data collection, since design and analysis costs will be similar. In-person interviews are generally the most costly and complex surveys to conduct, due to the logistics of traveling door-to-door. The cost of telephone surveys will vary with the length and complexity of the survey and the sample size. Costs of the mail survey vary with the size of the mailing and the number of follow-up mailings used.

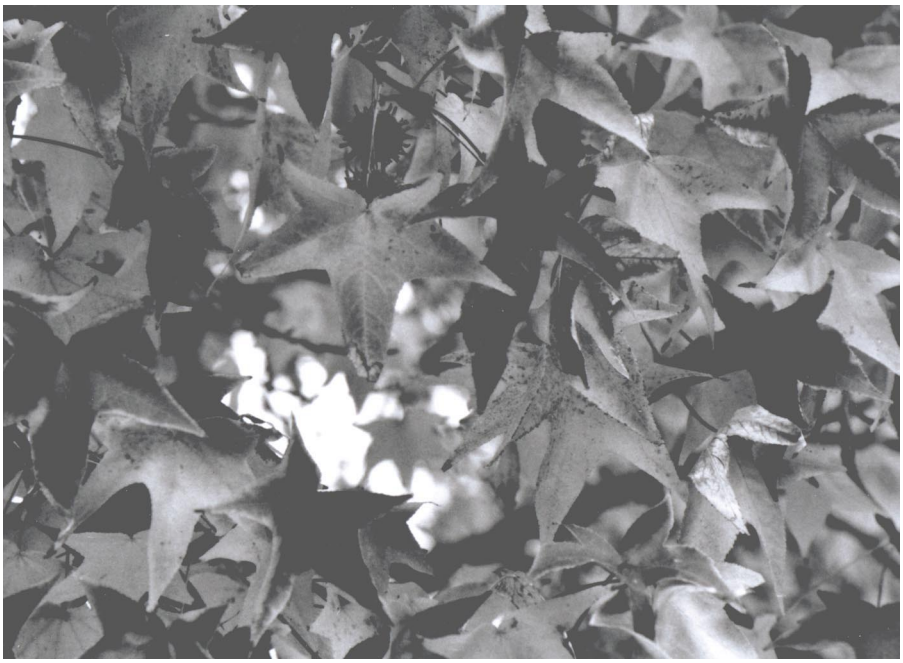
Good survey design and sampling technique are critical to the success of sample surveys conducted by any method. Care must also be taken in the data collection and entry process, to avoid introducing errors. Finally, even a well-conducted survey will not yield meaningful results if data analysis and interpretation are flawed. Thus, while the concepts behind public polling are reasonably straightforward, there is a fair amount of art and science involved in conducting a useful study. Gross design and execution errors can lead to meaningless or misleading results. More subtle errors may not completely invalidate survey results, but can decrease the reliability of the study.

If you are interested in conducting a public survey but lack the necessary technical background or resources, there are various sources of assistance available. Survey research units are associated with a number of state college and university campuses. Some of these units, such as the Survey Research Center of the University of California at Berkeley can contract with cities or counties to design or conduct surveys. Others may provide information or assist in studies on a cooperative basis. In addition, a number of private firms specialize in conducting public surveys primarily for market research. The scope of services provided and quality of work performed by these or other consulting firms can vary widely, so careful shopping is advised.

Sampling considerations. For all but the very smallest municipalities, assessments of citizen attitudes and knowledge will be based on polling a representative sample of the total population. While most of the points noted above under "A few words on sampling" apply, demographic factors also need to be considered to avoid bias in the study design. For instance, Sommer et al (1990) found that compared to younger citizens, older citizens were more likely to have negative opinions about street trees in front of their homes. It may be desirable to account for differences due to age, sex, sociological, or other demographic factors in the survey. Such information may help local governments decide whether education or other programs need to be targeted toward certain segments of the population.

Example: *Homeowner attitudes toward trees*

Sommer (1989) gives the following example of how information from a mail survey can be used in urban forestry management. European elms are a common street tree in the downtown area of Sacramento. These large trees are attacked by elm leaf beetle each summer, and the mess associated with these infestations had drawn numerous complaints. In response, the city had initiated an elm replacement program, which in turn provoked a public outcry, although not necessarily from the affected neighborhoods. When the city conducted a mail survey of householders in the downtown area, it found that the majority liked their elm trees, and wanted them retained. This data was then used to revise city policies regarding elms.



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